NOVEMBER, 1925

Railway Engineering and Maintenance

The Lanes of Commerce
THAT ARE BOUNDED BY THE
WATERS OF THE SEVEN SEAS
FIND RAILROADS USING
EPENDABLE RAIL ANTI-CREEPERS
CHICAGO THE P. & M. CO. NEW YORK
MONTREAL LONDON PARIS CALCUTTA

HY-CROME

HY-CROME, the metal of lasting resistance to fatigue—the nut lock of permanent rail joint security.

A perfected piece of railway equipment for which there is no economical substitute.

THE RELIANCE MFG. CO.
MASSILLON, OHIO

ST. LOUIS SAN FRANCISCO
NEW YORK CLEVELAND DETROIT CHICAGO

Montreal, Quebec, Canada, McGill Bldg., Engineering Materials, Ltd.
N. S. Kenney, Munsey Bldg., Baltimore, Md.

RAILWAY ENGINEERING AND MAINTENANCE
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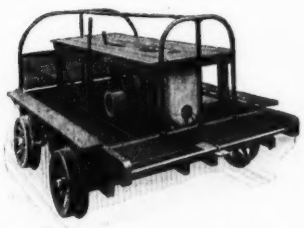
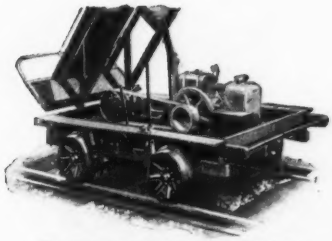
Alphabetical Index to Advertisers, Page 52 Classified Index to Advertisers, Pages 50-52

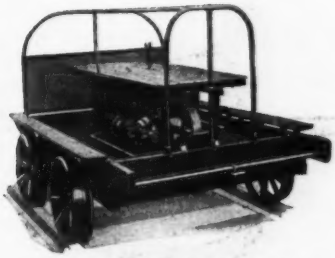
Mudge Motor Cars



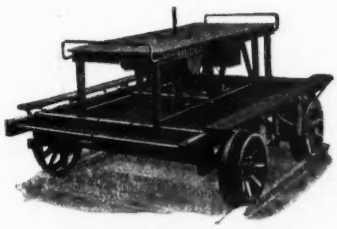
The "All-Service" Class" W S-2



The "Heavy Duty" Class W S-3

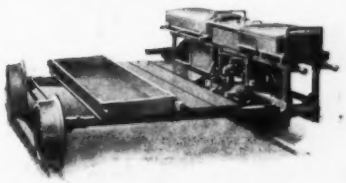


The "Wonderpull" Class G S-4

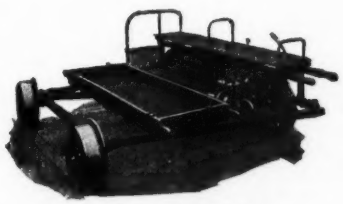


The "Standard Section" Class E S-3

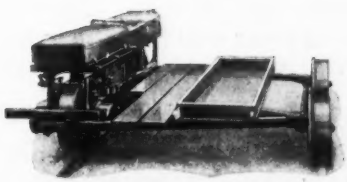
TRADE MARK
RAILROAD SPECIALTIES
CHICAGO
MUDGE



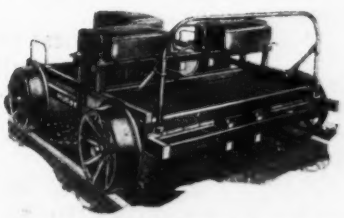
The "Power Queen" Class G-2



The "Special" Class E-11



The "Hill Climber" Class E-4



The "Safety First Roadster" Class E-60

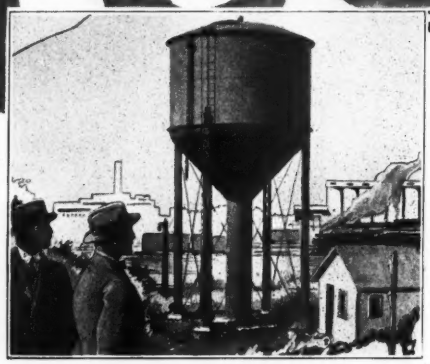
Eight Types of Cars—but only Three Types of Engines

Does Interchangeability of Engines and Parts Interest You?

Mudge & Company

Manufacturers—Railroad Equipment
Railway Exchange Bldg. - CHICAGO

Steel



THE trim-looking HORTON steel tanks not only add to the appearance of the right-of-way, and thus make a favorable, businesslike impression upon passengers and shippers, but provide a superior water service at a lower ultimate cost.

In the first place the water is clean. Clean water means cleaner locomotive mileage, and you will find the mechanical department of your road approves HORTON tanks because they deliver only clean water.

Cleaning the conical-bottom tank is simple, and in impressive contrast to the hand methods which must be employed in cleaning flat-bottom tanks. The washout valve in the bottom of the mud drum needs only to be opened at intervals and the pressure of the water floods out the accumulated sediment.

The well-known obvious advantages of the HORTON conical-bottom tank should not be lost sight of. It will not leak. It is fireproof, for it has no frost casing or other parts which can burn. It is steel!

CHICAGO BRIDGE & IRON WORKS

CHICAGO, 2452 Old Colony Building. NEW YORK, 3156 Hudson Terminal. CLEVELAND, 2202 Union Trust Building. DALLAS, 1646 Praetorian Building. SAN FRANCISCO, 1007 Rialto Building. ATLANTA, 1036 Healey Building. HORTON STEEL WORKS, LTD., Bridgeburg, Ont.; Montreal; Toronto; Winnipeg

405

HORTON

ELEVATED TANKS ÷ FLAT BOTTOM TANKS ÷ GAS HOLDERS ÷ PENSTOCKS ÷ SURGE TANKS

The Famous V-notch in the Horseshoe falls.

Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

Vol. 21 November, 1925 Number 11

TABLE OF CONTENTS

Editorials 429
Letters to the Editor 432
Frisco Studies Various Methods of Making Tie Renewals; J. M. Sills 433
Australian Railways Try Cure for Spike Killing 437
A New Substitute Tie 437
Are Rail Failures Confined to American Roads? 438
Bureau of Safety Holds Track Forces Responsible for Accidents 441
Bridge and Building Association Meets at Buffalo 443
Report on the Handling of Minor Maintenance Jobs 444
Report on the Relative Merits of Steel and Wood Sash 448
The Reduction of Accidents to Employees 450
Report on Electrically Operated Pumping Plants 454
The Treatment of Water for Locomotive Use; R. C. Bardwell 456
The Use of Precast Concrete Units 458
What's the Answer 463
New and Improved Devices 468
With the Associations 470
The Material Market 470
News of the Month 471

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WOULD YOU LIKE TO KNOW

How the cost of several methods of renewing ties compare?

What is being done to cure spike killing of ties?

The correct signals for locomotive crane operation?

How to dispose of water softener sludge?

How to protect water tank switch control float from freezing?

Answers to these and other questions will be found in this issue.

ELMER T. HOWSON, *Editor*
WALTER S. LACHER, *Managing Editor*
N. D. HOWARD, *Associate Editor*
H. F. LANE, *Associate Editor (Washington, D. C.)*

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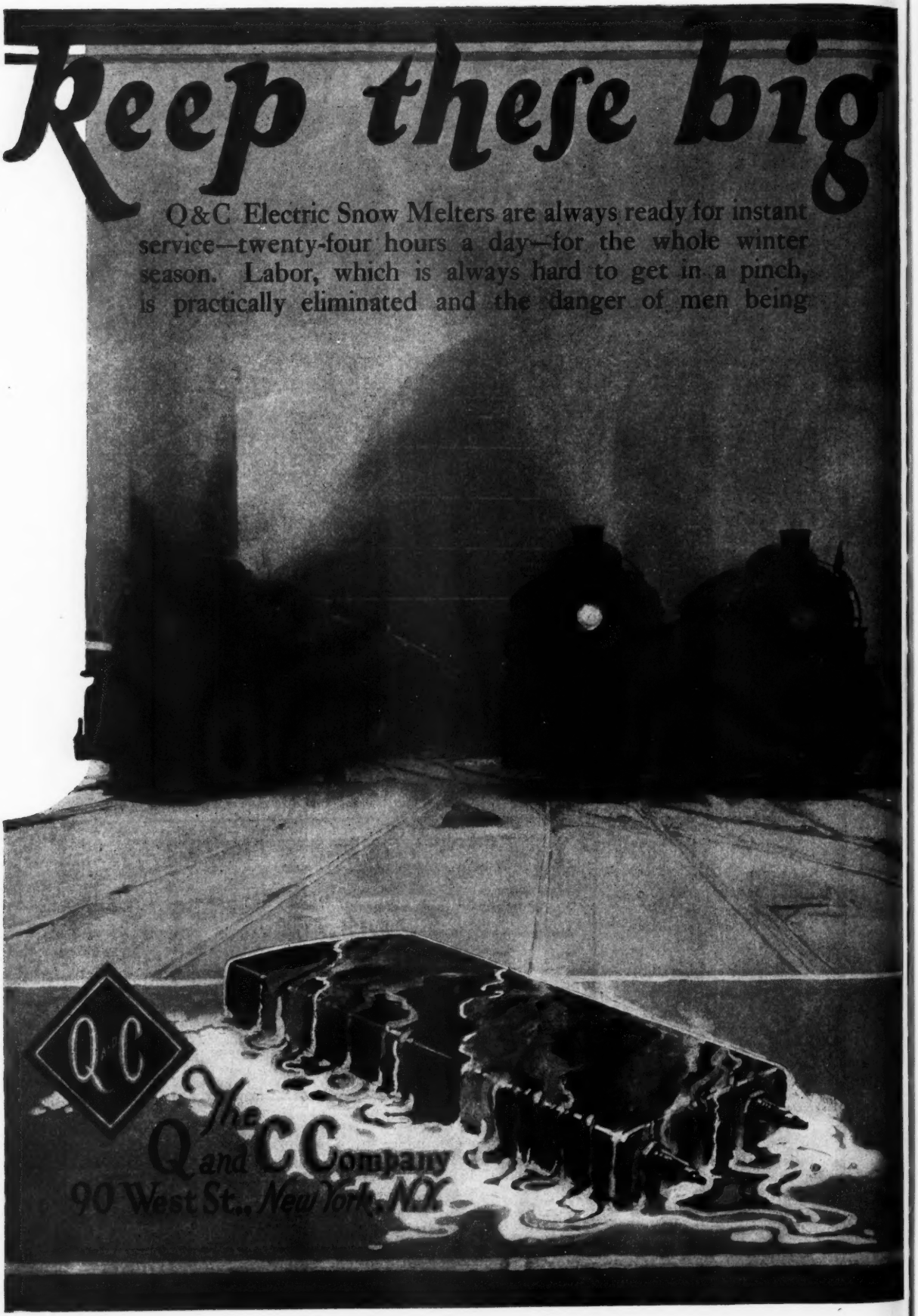
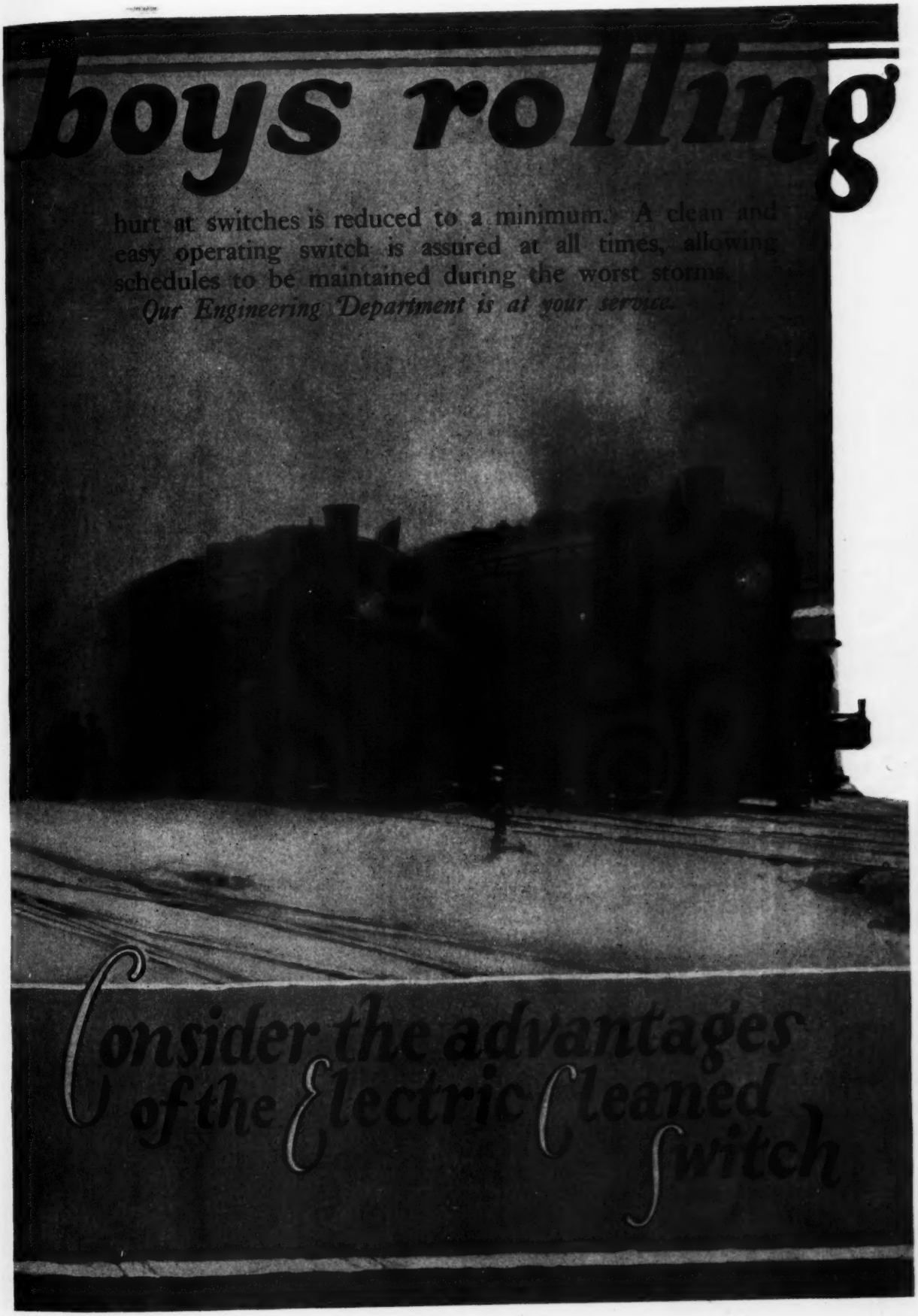

Keep these big
Q&C Electric Snow Melters are always ready for instant service—twenty-four hours a day—for the whole winter season. Labor, which is always hard to get in a pinch, is practically eliminated and the danger of men being
Q C
The Q and C Company
90 West St., New York, N.Y.


boys rolling
hurt at switches is reduced to a minimum. A clean and easy operating switch is assured at all times, allowing schedules to be maintained during the worst storms.
Our Engineering Department is at your service.
Consider the advantages of the Electric Cleaned Switch

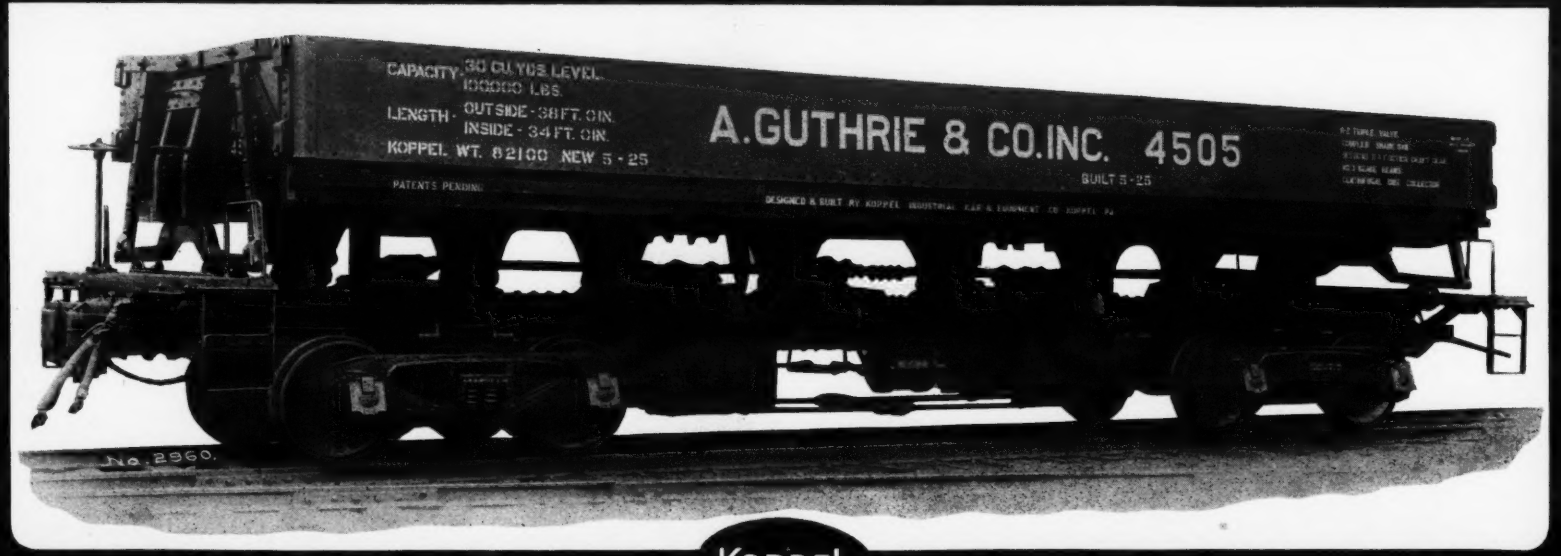
Examine This Car —

You men who believe in Economy — and exert every effort to keep down costs — Examine

The Koppel Automatic Air Dump Car.

Koppel Industrial Car and Equipment Company, Koppel, Pa.

New York Chicago Pittsburgh San Francisco


CAPACITY - 30 CU. YDS. LEVEL
100000 LBS.
LENGTH - OUTSIDE - 38 FT. 0 IN.
INSIDE - 34 FT. 0 IN.
KOPPEL WT. 82100 NEW 5-25
A. GUTHRIE & CO. INC. 4505
BUILT 5-25
PATENTS PENDING
No. 2960.

KOPPEL

A UNIVERSAL ELECTRICAL LABOR SAVING UNIT
for the
MAINTENANCE OF WAY DEPARTMENT

NUT TIGHTENER

In changing out rail joints, each Power Plant is capable of operating a wrench, which will set up a nut in ten seconds.

TIE TAMPER

Each Power Plant will supply current for the operation of four tampers. A gang of four men equipped with electric tampers will do the work of 16 men with picks and shovels.

PORTABLE GRINDER

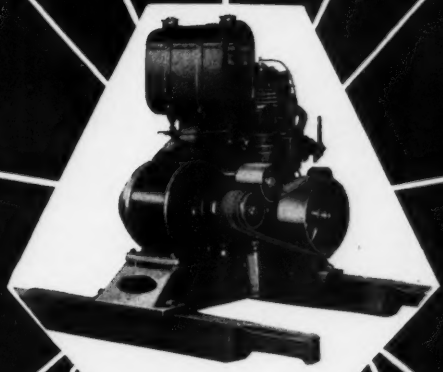
The Power Plant will operate grinders for smoothing up such jobs as a weld on a battered rail end.

RAIL DRILL

By the substitution of a drill for the socket wrench, the same tool used for the tightening of nuts can be employed for drilling rails.

SCREW SPIKE MACHINE

The Power Plant is practically indispensable for operating screw spike driving and pulling machines on tracks where screw spikes are used.



RAIL SAWS

Each Power Plant will operate 2 saws, permitting sawing of battered rail ends without removing the rail from the track.

BONDING DRILL

Each Power Plant will operate a battery of 6 drills. Savings of time and labor result as the drilling of each hole takes but a few seconds.

TUNNEL LIGHTING

Power Plants can be located where desired or a power line strung through the tunnel. Each Power Plant will operate 12 100-watt lamps.

PORTABLE POWER PLANT

A 1.5 K. W. Universal 110-volt DC and AC generator belted to a 5 H.P. gasoline engine. Light in weight and portable, it can be moved anywhere along the track as no special foundation is required.

FLOOD LIGHT

The light weight and portability of this Power Plant makes brilliant lighting available for such emergency jobs as washouts, wrecks, etc.

BRIDGE WORK

The Power Plant supplies ready current for the operation of drills, reamers and hammers on structural steel or for boring timber on bridge work.

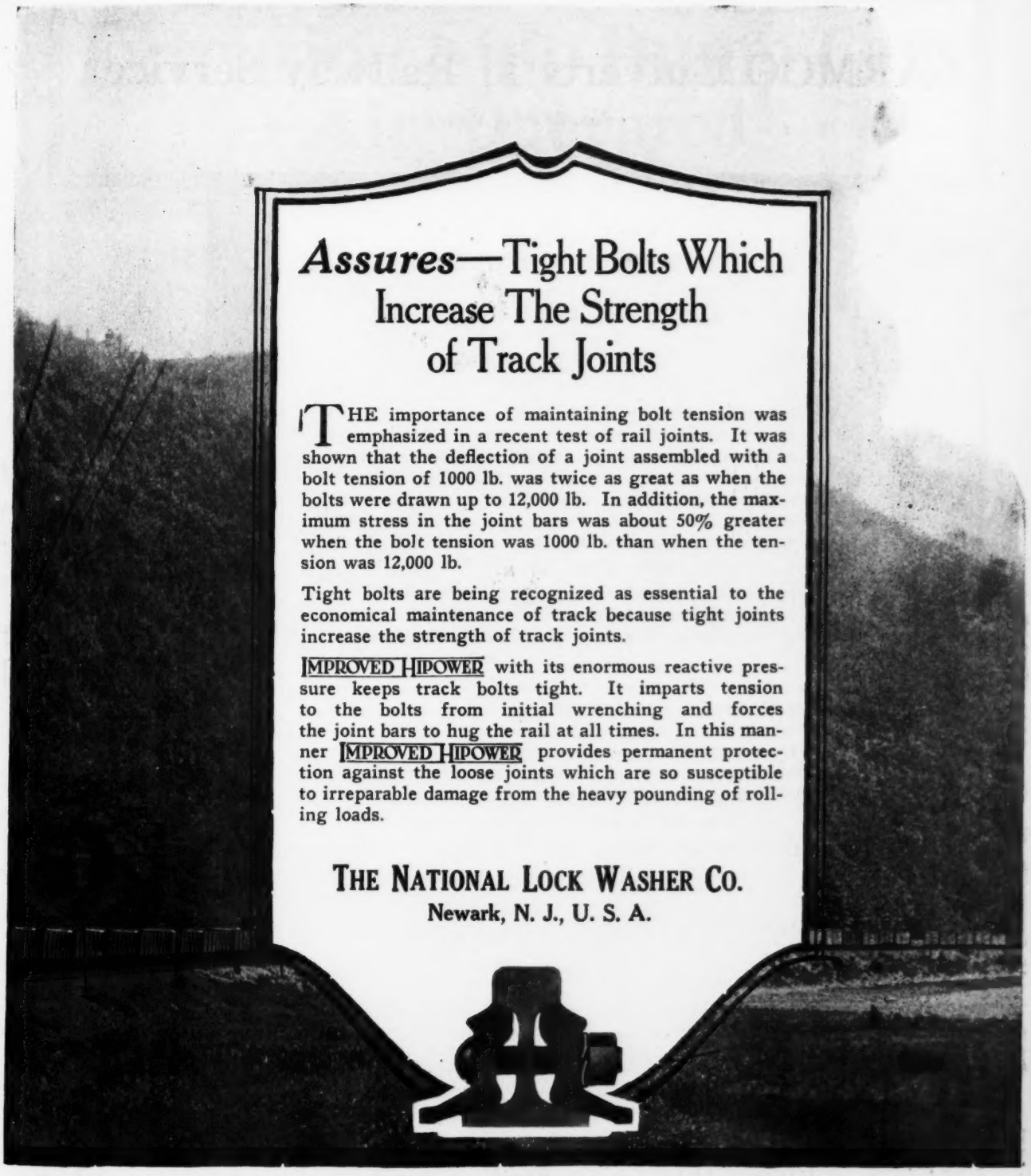
MISCELLANEOUS

The Power Plant can be set up and used as an added source of power at any point and is always ready for a wide range of applications.

ELECTRIC TAMPER & EQUIPMENT CO.
RAILWAY EXCHANGE BUILDING
CHICAGO, ILL.

IMPROVED

HIPOWER



Assures—Tight Bolts Which Increase The Strength of Track Joints

THE importance of maintaining bolt tension was emphasized in a recent test of rail joints. It was shown that the deflection of a joint assembled with a bolt tension of 1000 lb. was twice as great as when the bolts were drawn up to 12,000 lb. In addition, the maximum stress in the joint bars was about 50% greater when the bolt tension was 1000 lb. than when the tension was 12,000 lb.

Tight bolts are being recognized as essential to the economical maintenance of track because tight joints increase the strength of track joints.

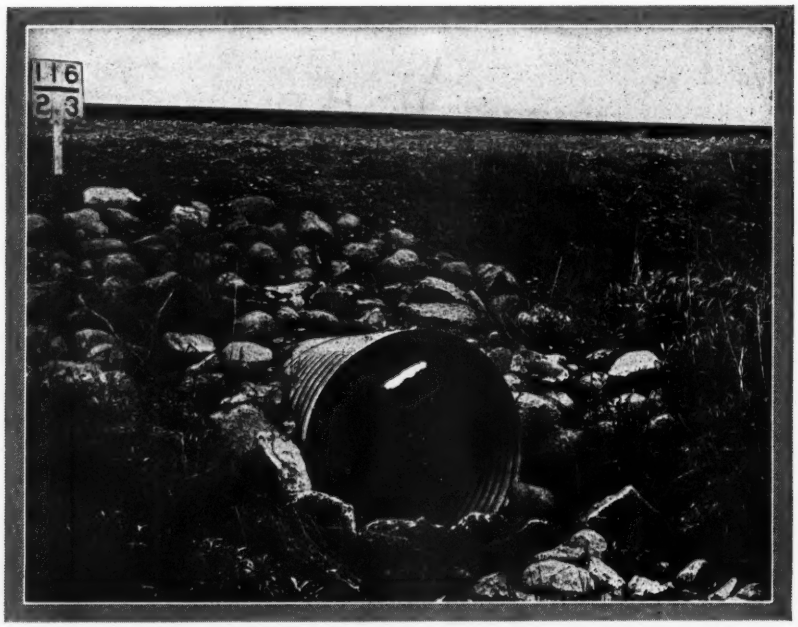
IMPROVED HIPOWER with its enormous reactive pressure keeps track bolts tight. It imparts tension to the bolts from initial wrenching and forces the joint bars to hug the rail at all times. In this manner IMPROVED HIPOWER provides permanent protection against the loose joints which are so susceptible to irreparable damage from the heavy pounding of rolling loads.

THE NATIONAL LOCK WASHER CO.
Newark, N. J., U. S. A.

Maintains the Bolted Security of Railway Track Joints

ARMCO Culverts in Railway Service

No. 25 of a Series



Name of Railway: Great Northern Railroad.

Location: Main Line, 7 mi. east of New Rockford, N. D.

Traffic: Fast and heavy trans-continental traffic.

Installation Data: 12-gauge, 36-inch ARMCO Culvert under 5-ft. fill of gumbo clay, slightly sandy. Installed 1910.

Condition: Excellent. Inspected and photographed May 17, 1922.

There is a manufacturer in almost every state and in Canada, making Culverts, Flumes, Siphons, Tanks, Roofing, etc., of genuine, rust-resisting Armco Ingot Iron. Write for full information and nearest shipping point on products in which you are interested

ARMCO Ingot Iron

ARMCO CULVERT & FLUME MFRS. ASS'N, Middletown, Ohio

ARMCO CULVERTS

Extension Side Dump Cars
··Air Operated··

FOR A GOOD JOB OF RIP-RAPPING

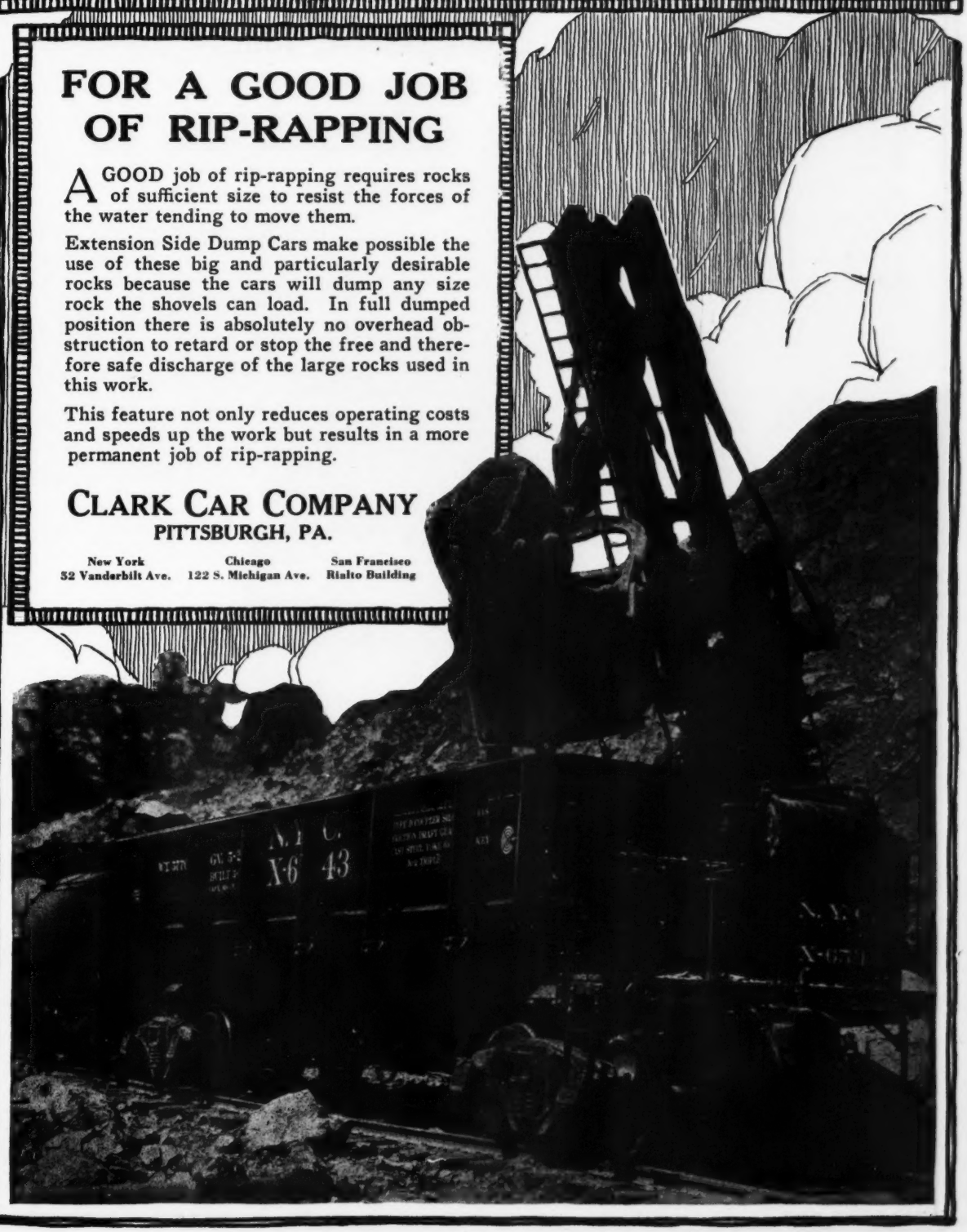
A GOOD job of rip-rapping requires rocks of sufficient size to resist the forces of the water tending to move them.

Extension Side Dump Cars make possible the use of these big and particularly desirable rocks because the cars will dump any size rock the shovels can load. In full dumped position there is absolutely no overhead obstruction to retard or stop the free and therefore safe discharge of the large rocks used in this work.

This feature not only reduces operating costs and speeds up the work but results in a more permanent job of rip-rapping.

CLARK CAR COMPANY
PITTSBURGH, PA.

New York	Chicago	San Francisco
52 Vanderbilt Ave.	122 S. Michigan Ave.	Rialto Building



BUDA
ESTABLISHED 1881

SPECIAL FEATURES

—of the—

New Improved Buda Ball Bearing Journal Jack

Lighter in weight.
More rise per height.
Less power required to lift the load.
Safety "Postop" prevents load being raised beyond limit of rise.
Improved lever socket.
Pawl and ratchet enclosed—packed in grease.
Lifting Screw is left-hand thread.
Load is raised by bearing down on the lever.
Casing is one piece—no attached cover for stem gear.
Gears are always maintained at their proper working centers.
Stem Gear has bronze bushing.
Standard is made from seamless steel tubing.
Screw is made from special alloy steel, machine cut, heat treated.
Nut special bronze.
Gears made from special alloy steel forgings and are heat treated.
Ball Bearings and Gears are packed in special graphite grease and require no oiling.

Latest Design and Most Efficient

Capacity:
25-Ton
35-Ton
50-Ton

Write for Descriptive Catalog

THE BUDA COMPANY

HARVEY (Chicago Suburb) ILLINOIS

30 Church Street NEW YORK
Railway Exchange CHICAGO
Railway Exchange St. LOUIS
664 Mission St. SAN FRANCISCO
LONDON

Western Dump Car Facts

Western Air Dump Cars with aprons in railroad betterment work.

Here are the facts:

Compared with old methods, Western air dump cars will pay for themselves.

They are two-way, automatic, air dump cars, dumping either way at will of operator. No preparation. Just move a lever one way or the other.

They can be equipped with aprons for the purpose of throwing the load outside the ballast.

So equipped, they can be righted instantly after dumping, without shoveling or moving up the train.

They have few castings, all very accessible. No need of tying up a small fortune in extra parts.

May we send a representative to explain more fully the economy of their operation? Write to-day please.

Why not RENT a few Westerns and charge the cost to maintenance. Write for particulars.

Western

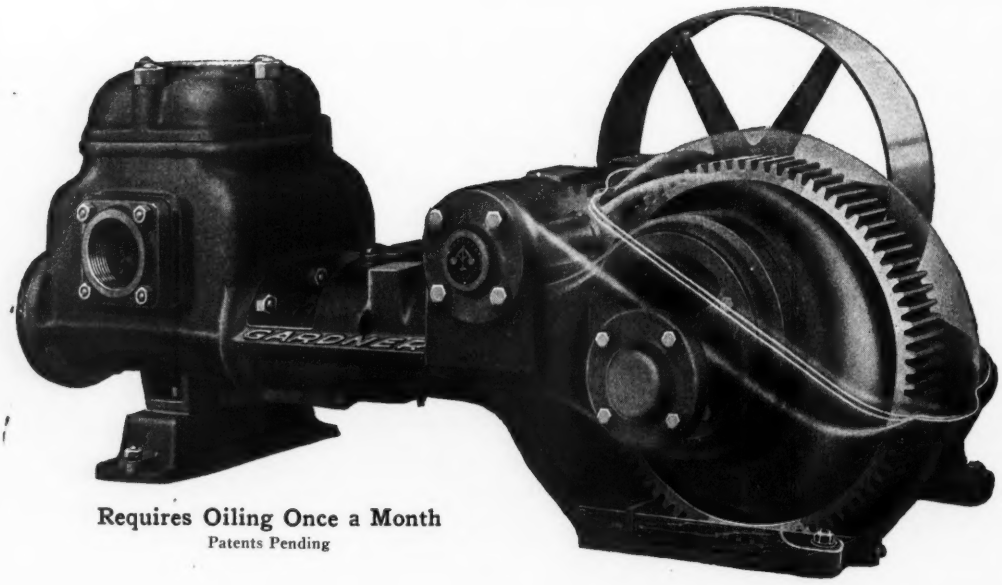
That's Why

WESTERN WHEELED SCRAPER COMPANY

Founded 1877

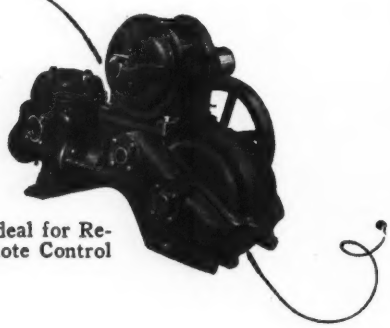
Earth and Stone Handling Equipment

AURORA, ILLINOIS



Requires Oiling Once a Month
Patents Pending

Years ahead of the field!



Ideal for Remote Control

The GARDNER Pump you buy today possesses the improvements that will appear on other pumps several years from now. GARDNER was the first to adopt and develop the principle of flood lubrication for duplex power pumps. We never stop improving GARDNER Pumps.

When you get a GARDNER Pump you have the assurance it is several years ahead of the field.

"Quality Builders for Over 65 Years"

THE GARDNER GOVERNOR COMPANY
Quincy, Ill.

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SAN FRANCISCO 401 Rialto Bldg | LOS ANGELES 2122 East 7th Street | LONDON 25 Bishopsgate, E. C. 2

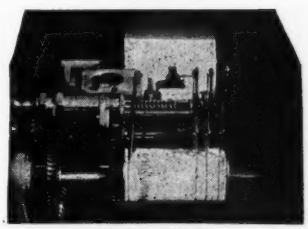
GARDNER

Fairmont Research in Motor Car Development Yields New Measuring Stick of Values!

Measuring Pulling Capacity by the Fairmont Dynamometer

The rated load, in men and tools, is carried on the motor car, and the dynamometer measures the surplus that the car is capable of at various speeds. Speeds are controlled by the man at the brake on trailer. Car operates at wide open throttle.

Performance on the Job Counts



The Fairmont Dynamometer

The only railway motor car dynamometer in existence. Measures

1. Maximum draw bar effort available for starting trailers.
2. Maximum draw bar pull at all speeds.
3. Maximum draw bar horse power at all speeds.
4. Economy (fuel consumption) at all loads and speeds.
5. Endurance (length of time car can sustain its maximum draw bar pull at a given speed).

For years the deciding factors in the selection of railway motor cars have been cost and performance records. These do not always take into consideration varying conditions of service. They are available only after considerable expenditure of time in observation. And the facts they offer are only *approximate*.

In view of these shortcomings Fairmont Engineers have developed a recording Dynamometer, which scientifically measures values, unbiased by personal opinion, and reveals in a *few hours* information on power economy and endurance that not even *years* of observation could disclose.

The progressive spirit which brought about this marvelous achievement has kept Fairmont constantly ahead in the motor car industry. More than half of all the cars manufactured each year are Fairmonts. 700 roads are benefiting from this leadership. Why not yours?

FAIRMONT RAILWAY MOTORS, Inc.

Fairmont — Minnesota

DISTRICT SALES OFFICES:

New York Chicago Washington, D.C. Winnipeg, Canada

Fairmont

Ball-Bearing Motors and Railway Motor Cars

HACKMANN COMBINATION TRACK LINER

SAVES 60% OF YOUR LABOR AND TOOL COST

HACKMANN Track Liners Will Line Track, Frogs, Switches, Space Ties, Raise Low Joints, Without Disturbing the Road Bed. No Digging Necessary

60% Labor Cost Saved

3 Men With Hackmann Track Liners Do the Work That Required 9 to 12 Under the Old Method Hackmann Track Liners Will Pay For Themselves By the Saving in Labor Cost

NO. 1 LINING BAR

HACKMANN COMBINATION LINING BARS

(VERONA MADE—HEAT TREATED)

The No. 1 lining bar with chisel end and the No. 2 combination tamping and lining bar are drop forged from special steel specially tempered with 1-inch drop forged lugs as an integral part of the bars, for use with Hackmann bases.

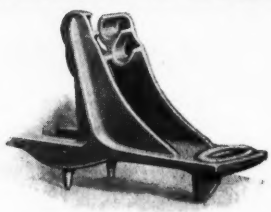
Tests on different roads have proven conclusively that the new Hackmann Combination Track Liner gives more than double the efficiency of any liner now on the market.

DEMONSTRATIONS

We Will Gladly Demonstrate the Efficiency of This Equipment Upon Request

NO. 2 TAMPING AND LINING BAR

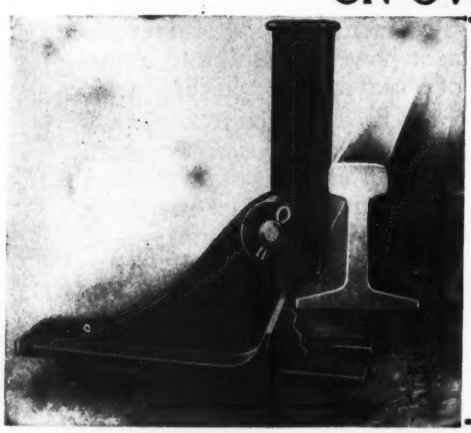
NOTE THE TWO STEP FEATURE AT TOP OF BASE



You can make at least two pulls without resetting the liner. Just move the bar to the top notch.

Weight 20 lbs.

MORE THAN 13,000 OF OUR LINERS NOW IN USE ON OVER 100 RAILROADS



The IDOL TRACK LINER

The Idol Track Liner will line track frogs, switches, space ties, raise low joints without disturbing the road bed as no digging is necessary. They will pay for themselves every day by work you will be able to do with a few men. They will save you 50% in labor costs.

The Idol Track Liner can be operated with any ordinary lining bar.

THE HACKMANN RAILWAY SUPPLY CO.

RAILWAY SAVING DEVICES
723 So. Wells St., CHICAGO, ILLINOIS

VERONA TOOL WORKS
New York, N. Y. Boston Mass.
Washington, D. C. Verona, Pa.
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FREDERICK HACKMANN,
President and Mechanical Engineer

LAUGHLIN & CHENEY
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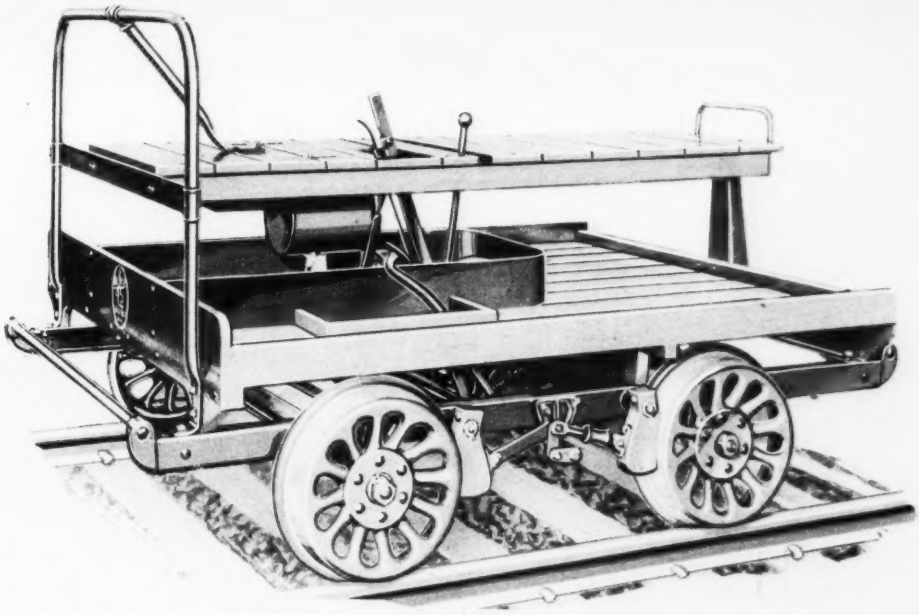
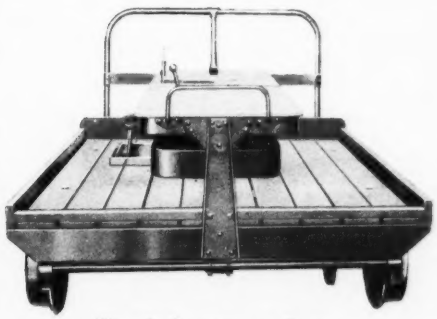
Toronto Montreal Winnipeg
Vancouver



Announcing
The Sheffield 45

Here is a new section car, with free running engine and friction transmission, which meets the demand for a car lighter and in a more moderate price class than the famous Sheffield 40-B—yet one which can give an excellent account of itself in average section service.



Note single support at the rear and exceptionally large deck space and accessibility of tools

Note these outstanding features

—Two-cylinder opposed air-cooled, four-cycle engine, with patented Ricardo cylinder head, widely known and adopted in automobile circles. This head, which is made removable in the Sheffield 45, gives 15 per cent more power. Three-point suspension at engine.

—Ignition from highly developed flywheel magneto, giving a hot spark at slow cranking speeds and insuring easy starting.

—Drop-forged crankshaft mounted on Timken Taper Roller Bearings which absorb all thrust and radial loads.

—A new and greatly simplified design of friction transmission. Countershaft mounted on S. K. F. self-aligning ball bearings.

—Pressed steel auto type frame which insures lightness without sacrificing strength.

—Largest deck space ever provided on a section motor car—twenty-two square feet of unobstructed tool space.

—Body readily lifted off by simply removing four bolts.

These and other advanced features make this car a notable addition to the Fairbanks-Morse line of section motor cars. Other models are described on next page.

FAIRBANKS-MORSE
MOTOR CARS

First on the rails – *and still first*

The Sheffield 40-B

—sets a new standard

The Sheffield 40-B, even better than its predecessor, the famous Sheffield 40, sets a new standard in motor car design, construction and performance. In every respect this car is an outstanding engineering achievement. The two-cylinder, air-cooled engine embodies the latest developments in automotive design. Three-point suspension insures perfect alignment. The crankshaft, made short, stiff and unusually strong to eliminate vibration, is carried on large Timken Taper Bearings. The friction transmission has been greatly simplified.

The new automobile type pressed steel frame, probably the strongest frame ever used on a car of this type, gives absolute rigidity. Ask for bulletin.

The Sheffield 44
—always on the job

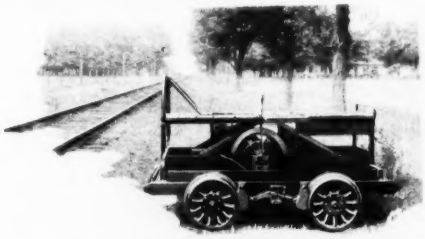
COALING STATIONS

The finest equipment backed by undivided responsibility permanently guarantees every coaling station.

Built throughout by

Fairbanks-Morse

The Sheffield 44, with chain drive and perfected clutch that *can't be burned out*, represents the highest development in one-cylinder, water-cooled motor car construction. No "strong arm" tactics needed with this car. No pulling and tugging on a tension lever. No broken belts and attendant delays. Speeds can be changed and loads started by slipping the clutch—almost with no effort. A specially designed clutch, with large faces and cooling fins that dissipate heat, makes smooth, positive clutch control a reality in the new "44." Ask for descriptive bulletin.



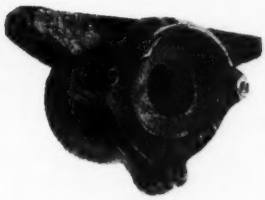
The Sheffield 44. Rugged, yet remarkably light, with chain drive and simple fool-proof clutch which will not burn out

FAIRBANKS, MORSE & CO., Chicago

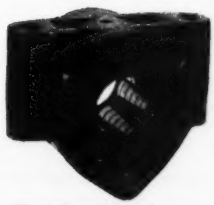
Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; oil engines; steam, power and centrifugal pumps; scales; complete coaling stations

FAIRBANKS-MORSE
MOTOR CARS

First on the rails – *and still first*



Buda

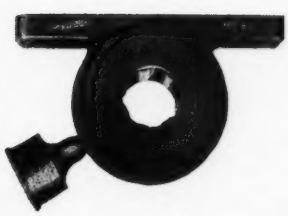


Fairbanks-Morse

Fairmont

Kalamazoo

Mudge



Northwestern

Maintenance economies inbuilt with Hyatt bearing equipment

WHETHER designed into new railroad section cars or used as replacements in old cars—Hyatt roller bearing equipment is your guaranty of long life, low maintenance cost and minimum operating expense.

Hyatt bearings cut the friction load 50%—a saving of 30% on the gasoline cost.

They reduce the push or pull effort 50%. One man can do the work of two.

Hyatt bearings require renewal of the lubricant only once in two or three months. They use 80% less oil than plain bearings and also save many hours of labor.

They give years of troublefree operation without repairs or replacements. That is why Hyatt roller bearings are installed in maintenance equipment going to Central and South America, far from the source of supplies.

The leading manufacturers listed below build these sturdy bearings into new cars and supply Hyatt bearing replacement boxes which can be easily and quickly installed in your plain bearing cars:

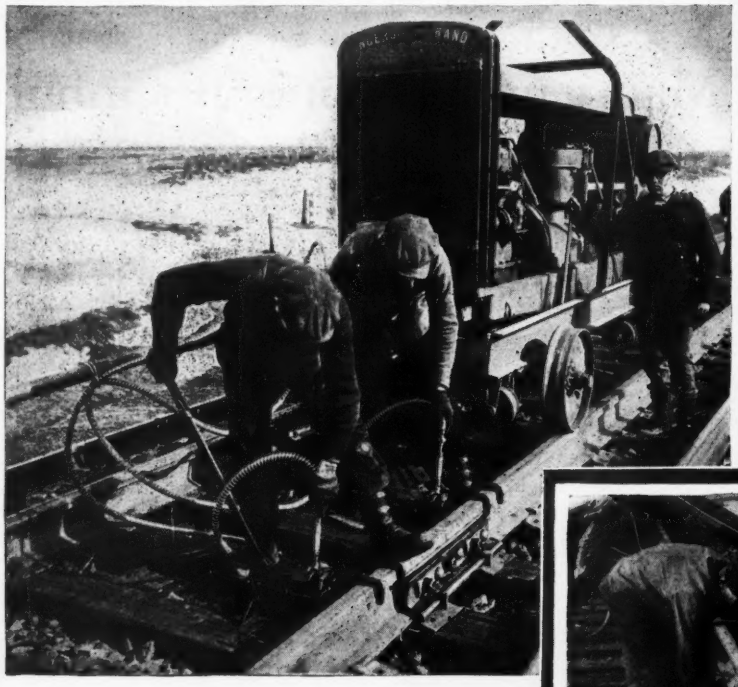
The Buda Co.	Chicago, Ill.
Fairbanks-Morse Co.	Chicago, Ill.
Fairmont Railway Motors, Inc.	Fairmont, Minn.
Kalamazoo Railway Supply Co.	Kalamazoo, Mich.
Mudge & Co.	Chicago, Ill.
Northwestern Motor Co.	Eau Claire, Wis.
Sylvester Mfg. Co., Ltd.	Lindsay, Ont., Can.

Any one of these companies will gladly give you further information.

HYATT ROLLER BEARING COMPANY

NEWARK DETROIT CHICAGO SAN FRANCISCO
WORCESTER PHILADELPHIA CLEVELAND
PITTSBURGH CHARLOTTE

HYATT ROLLER BEARINGS FOR RAILWAY MAINTENANCE CARS



Left—Size 9x8 Tie Tamper Compressor operating rail bonding drills in winter work. Two of the eight drills are shown.

Below — Bolting up rail joints with air drills.

Bottom — Drilling holes in rail with air drills.

Year-'Round Savings

from

Pneumatic Tamping Outfits

Ingersoll-Rand Tamping Outfits make possible the use of labor-saving tools and methods on a variety of jobs, summer and winter.

In the tamping season, they are kept busy tamping track faster, better, and at less cost than by hand methods.

When not used for tamping, these portable compressor units supply air power for labor-saving air tools on rail-laying operations, bridge repair and maintenance work, and other jobs along the line which would otherwise require costly hand labor.

The accompanying illustration shows a tie tamper compressor operating rail-bonding drills, pneumatic wrenches, and rail drills. Send for a complete list of the many ways in which these units can save you time and labor.

INGERSOLL-RAND COMPANY

11 Broadway New York City

OFFICES IN PRINCIPAL CITIES THE WORLD OVER.

For Canada Refer—Canadian Ingersoll-Rand Co. Limited, 260 St. James Street, Montreal, Quebec

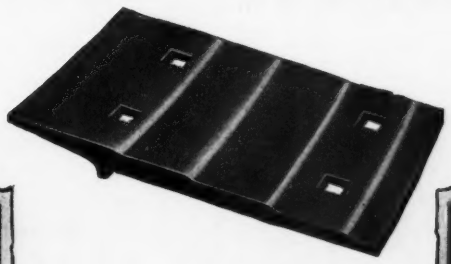
219TT

Ingersoll-Rand

Under the same traffic conditions

LUNDIE TIE PLATE

Gives tie protection



Lundie protection

Tie destruction

FIVE YEARS of identical service on a heavy traffic eastern road show the actual saving in costly ties through Lundie Tie Plate protection.

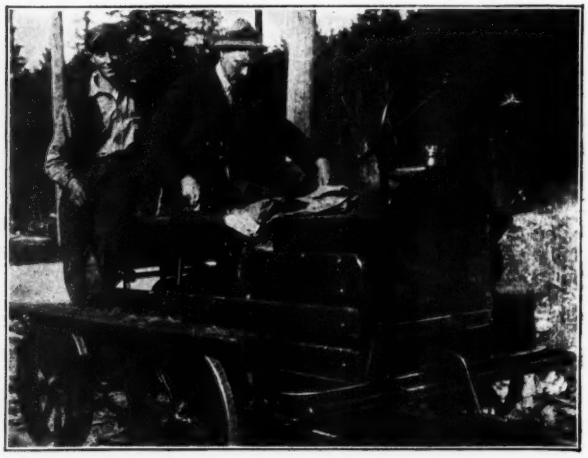
One tie nearly worn out.—The Lundie protected tie, good for many more years of service.

Such remarkable saving is due solely to the design of the Lundie Tie Plate, which compresses the tie, without cutting a single fibre.

The Lundie Engineering Company
920 Broadway, New York
166 West Jackson Boulevard, Chicago

A wheel must have remarkable strength to stand the grinding wear of a logging track. When these pictures were taken, Parsons Wheels, running on a Casey Jones 550 motor car, had already delivered four times the service obtained from ordinary wheels—and still the Parsons Wheels showed no signs of unusual wear.

It makes a man feel like smiling to know that the wheels are going to last as long as the car.



Parsons Wheels Made Good on Roads Like This

Patents Pending

A new bulletin, "Stronger Links in the Chain of Safety," gives construction details of Parsons Wheels. It also describes laboratory and service tests through which these wheels have become a factor in safe, modern railroading. We will be glad to send you a copy.

And they are making good on more than twenty transcontinental railroads. One-piece design and cast-steel construction give them twice the strength, three times the wear of ordinary wheels.

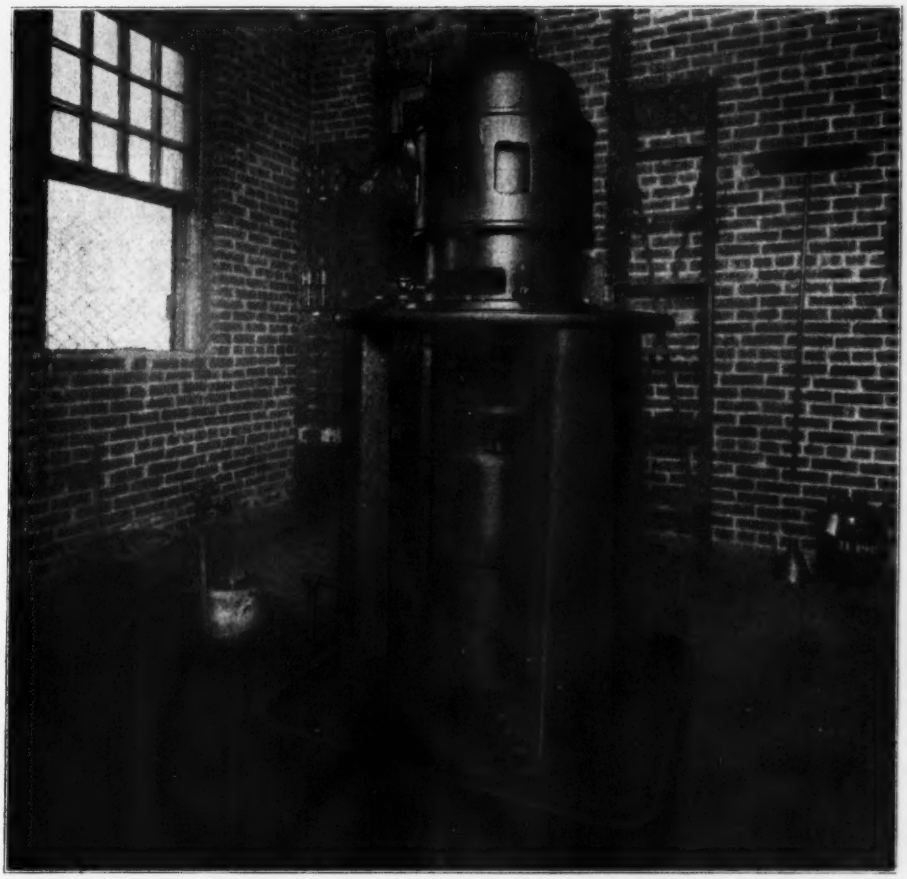
M. W. officials who are not now using Parsons Wheels will be interested in the special Parsons Test Plan. Outlined in full on request.

The Parsons Company
Newton, Iowa, U. S. A.

PARSONS WHEELS

ONE-PIECE CAST-STEEL *for* **RAILWAY MOTOR CARS**

AMERICAN
AURORA, ILL.



THE "American" Deep Well Turbine illustrated above is designed to furnish 500 G. P. M. against a 110-foot total head, and is installed at the C. & E. I. Railroad, Jackson Yards, Clinton, Indiana.

This deep well turbine is used for serving the water tank at this station. This type of equipment lends itself readily to automatic and remote control, and consequently requires less attendance than is usual.

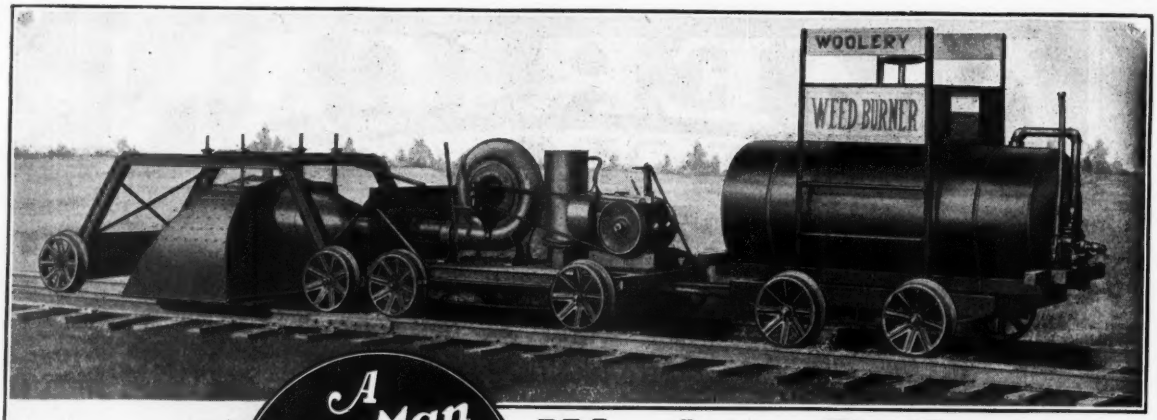
GENERAL OFFICES AND WORKS - AURORA, ILL.

THE AMERICAN WELL WORKS

NEW YORK, N. Y.....165 BROADWAY
MILWAUKEE, WISC.....WISC. NAT. BANK BLDG.

BRANCH OFFICES

CHICAGO, ILL.....FIRST NATIONAL BANK BUILDING
DALLAS, TEXAS....WESTERN INDEMNITY BLDG.
SAN FRANCISCO, CALIF.....635 MISSION STREET



A Two-Man Outfit of Guaranteed Efficiency
Average cost on first heavy burning less than $3.00 per mile

Note the clean, wide burned area that the Woolery leaves behind. In some places the weeds and quack grass had attained a height of 27 inches.

Woolery Railway Weed Burner

(Patent Applied For)

A self-propelled, three-unit outfit operated by two men. Speed from 1 to 5 miles per hour for burning, and up to 20 miles an hour for traveling. Compared with large and cumbersome machines, the Woolery is light—quick—nimble. Being easy to handle and quick to fire it gets around and can be used in places and on short burnings where other machines would be impractical. It may be removed from track at highway crossings. Total length of outfit, about 34 feet.

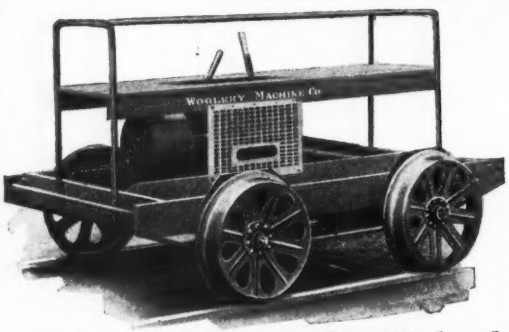
High Lights on the Woolery Weed Burner:

A Three-Unit outfit operated by TWO men.
Burns Gas Oil, Distillate Oil or Kerosene, and fire starts instantly.
ONE large Oil Burner—never whips out by tall weeds.
Burns a strip 11 feet wide.
Average burning rate, 2 miles per hour.
Fire may be shut off when crossing bridges. No drip of oil.
Fire relights automatically when fuel is turned on.
Outfit carries supplies for a full day's operation.
Any speed from 1 to 20 miles per hour on its own power.
Easily loaded on a flat car for long moves.
Operation is simple and easily learned.
All steel construction—safe and dependable.
Low fuel consumption, thoro work, and no train crew.
A clean, dry, withering hot fire—leaves no oil on the rails.
Four-Wheel Drive and Four-Wheel Brake—ample traction and safety.
Chrome Nickel Steel Ball-Bearing Axles—Strong and Easy-Running.
Entire workings of machine controlled from Driver's seat.
It may readily be removed from track at a highway crossing.

Always Ready for a Demonstration on Any Railroad

Read this ☞

Meet us at the Track Supply Association Exposition at Booth 30, Convention Hall, Kansas City, Mo., Sept. 22, 23 and 24, 1925



The Woolery (Model M) Railway Motor Car

Light in Weight—100 Per Cent Overload

A car for every road—for any Climate—for all kinds of Service. Power to meet requirements. It can be used as Section Car, Extra Gang Car or Small Work Train. Normal Capacity, 10 passengers. Instantly removable side seats which increases the seating capacity to 20 men, can be supplied. Chrome Nickel Steel Ball-Bearing Axles. Steel Hand Railing and Lift Handles, Steel Engine and Wheel Guards. Steel Truss Frame contributes enormous strength.

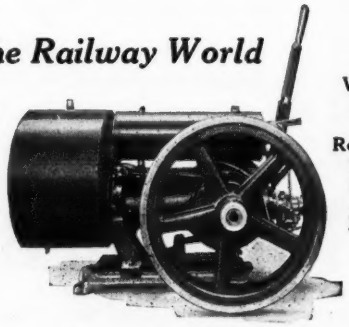
The Power Plants that Make the "Woolery" the Marvel of the Railway World

The Woolery Model "C" Reversible Engine

A powerful, light weight ball-bearing engine with speed control of from 400 to 1200 revolutions per minute. Develops 9 horse power on the brake test. Designed to use gasoline, but works efficiently on a mixture of kerosene and gasoline.

The Woolery Model "TC" Twin Cylinder, Reversible Engine with Two-Speed Transmission

Ball-bearing, perfectly balanced, and smooth running. Develops 18 horse power on the brake test. Admirably adapted to the heavier class of section and construction work, and is powerful enough to save a work train many trips.



The Woolery Model "C" Reversible Engine 9 h. p. on the Brake Test

Write for Full Information and Detailed Description of Woolery Railway Motor Cars and Engines

WOOLERY MACHINE CO., Minneapolis, Minn.

A MOUTHFUL at EVERY BITE

Guarantee

Owen Buckets, properly installed and operated, are guaranteed to do a bigger day's work than any other bucket of the same weight and capacity—

—or—

Write your own guarantee!

THE OWEN BUCKET CO.

The sharp, cruel strength of the gorilla's massive jaws gain for him a mouthful at every bite. This giant of Africa's ape family tears away his heaping bite with a powerful force that parallels the action of an Owen Bucket.

When an Owen Bucket strikes the material, the centralized weight enables the teeth or edges to get a starting hold. As the closing line is overhauled the bucket cannot rise before digging in for a chuck-full load.

An Owen Bucket is designed and constructed to absorb without effect the knocks, and racks, and falls, and all of the abuse that shortens the life and earning power of the ordinary bucket.

Just as the gorilla is the "tree-top" king of the jungle—so is the Owen the "dig-in" king of buckets.

Write for the complete story of Owen Buckets and their nine distinctive points of superior construction.

The OWEN BUCKET Co.

1105 Rockefeller Building Cleveland, Ohio

Baltimore Chicago Dallas Los Angeles Minneapolis Philadelphia
Pittsburgh New York Miami Portland St. Louis San Francisco

Four 1 yard Type "J" Digging Buckets used by Geo. H. Fuller Co., to dig Footings for foundation for Brotherhood of Locomotive Engineers Bank Building.

OWEN CLAMSHELL BUCKETS INSURE A BIGGER DAYS WORK

Owen Buckets

INSURE A BIGGER DAY'S WORK

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THE OXWELD RAILROAD SERVICE COMPANY

representing

THE LINDE AIR PRODUCTS CO.
(Linde Oxygen)

THE PREST-O-LITE CO., Inc.
(Prest-O-Lite Acetylene)

UNION CARBIDE SALES CO.
(Union Carbide)

OXWELD ACETYLENE CO.
(Oxweld Apparatus and Supplies)

Railway Exchange
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30 East 42d Street
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RACOR

SEVEN WORKS
RAMAPO-AJAX-ELLIOT
HILLBURN, NEW YORK
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PUEBLO, COLORADO
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NIAGARA FALLS, CANADA

HEAVY DUTY HEAT TREATED GUARD RAIL CLAMPS
DROP FORGED RAIL BRACES
ADJUSTABLE RAIL BRACES
EUREKA ADJUSTABLE CLIPS
MANGANESE REINFORCED SWITCH POINTS
RAMAPO AUTOMATIC SAFETY SWITCH STANDS
AJAX MANGANESE ONE-PIECE GUARD RAILS
SWITCHES – FROGS
CROSSINGS – SPECIAL
RAILWAY TRACK WORK

RAMAPO
Safety Switch Stand
Style No. 17

RACOR
Heat Treated Heavy
Duty Guard Rail Clamp

RACOR
Adjustable
Rail Brace

RACOR
Drop Forged
Rail Brace

RAMAPO
Safety Switch Stand
Style No. 39-B

AJAX MANGANESE
One-Piece
Guard Rail

RACOR
TRADE MARK

EUREKA ADJUSTABLE
Open Side Switch Clip

Main Office – HILLBURN, NEW YORK
SALES OFFICES AT WORKS, ALSO
30 CHURCH STREET, NEW YORK
McCORMICK BUILDING, CHICAGO

RAMAPO AJAX CORPORATION

There is never any guess work about *International* Treatment

THERE are no "hit and miss" methods in the production and treatment of ***International*** Ties.

All ties are measured and graded in strict accordance with A.R.E.A. Specifications. The ties are under constant trained supervision during the seasoning period.

Each shipment of preservative is analyzed to insure that it meets specification requirements.

Scientific application of correct principles under chemical supervision are used for treatment.

Every modern mechanical device is installed to assure accuracy.

After treatment increment borings are taken from ties in every charge to check the depth of penetration.

The unusual experience of ***International*** as specialists in the production and treatment of timber is a guarantee of its ability to get results—and it's results you are after.

International Creosoting & Construction Co.

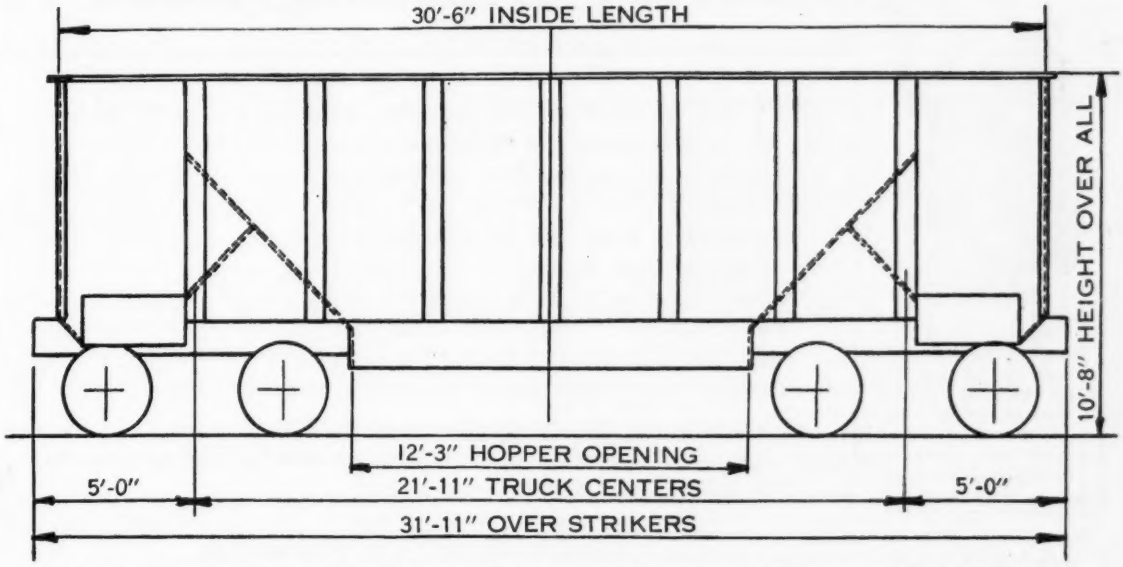
General Office—Galveston, Texas

Plants: Texarkana, Texas Beaumont, Texas
Galveston, Texas

HART SELECTIVE CAR WITH "MAXENDS"

FOR BALLAST AND COAL

"MAXENDS" PROVIDE FULL MAXIMUM COAL CARRYING CAPACITY



DISTRIBUTING BALLAST TO CENTER AND TO ONE SIDE

Each side is operated independently in full view of operator as shown. Amount of distribution under control, as desired for shoulder reinforcement.

Cut to right shows same piece of track after car has passed. Note even distribution of material, no hand work having been done.

Cut to left shows actual work being done by this car, depositing material simultaneously to center and outside of elevated rail on curve for reinforcement.

RODGER BALLAST CAR COMPANY

523 Railway Exchange, 80 E. Jackson Blvd.

CHICAGO

How to Secure Better Blasting Results

Du Pont chemical engineers insure uniformity of quality by chemical control through every step of manufacture from raw material to finished product.

THE solution of blasting problems can be accomplished by adopting the methods proposed by the explosives experts composing the technical field staff of the du Pont Company.

Equipped with an extensive experience covering the selection and use of explosives, these expert "powder" men carry on their investigations in a thorough and efficient manner. The result is a practical and effective plan whereby the explosives required perform their work with a minimum expenditure of material, labor and time.

Put your powder problems up to du Pont,—over 123 years of continuous activity in developing and making explosives for every requirement.

Blast with du Pont explosives

There is a du Pont explosive to meet every blasting need—to do *your* particular work *best* at *least* expense. For contracting we especially recommend:

Red Cross Extra Dynamite: 20% to 60% strength; low-freezing; fairly water-resisting; heaving and lifting action.

Du Pont Gelatin Dynamite: 25% to 90% strength; water-resisting; low-freezing; dense; plastic; less obnoxious fumes.

Du Pont R. R. P., (Judson type): 5% strength and low-freezing.

Du Pont Blasting Powder is the most widely used low explosive. It is regarded as standard everywhere. Every keg bears the orange band.

Du Pont Blasting Accessories give you maximum efficiency from your explosives. Make every shot *sure*—protect your blasting investment by using only du Pont accessories.

For further information about du Pont explosives and blasting accessories, please refer to Road and Street Catalog,—or write to our nearest office.

Branch Offices:

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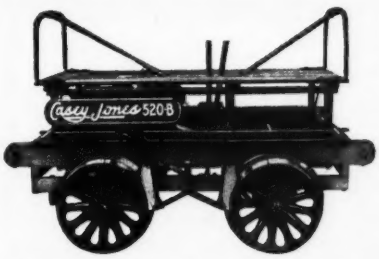
Du Pont Products Exhibit
Atlantic City, N. J.

E. I. DU PONT DE NEMOURS & CO., INC.
Explosives Department
WILMINGTON, DELAWARE

DU PONT

POWDER MAKERS SINCE 1802



For All Section Gangs

Equipped with a 6 h. p. ball bearing free running engine, this car is capable of handling all section gangs. The most efficient and economical section motor car—lowest first cost—lowest cost of operation and repairs.

$199.00 F.O.B. Eau Claire

Casey Jones 520 B Standard Section Motor Car

A NEW STANDARD OF MOTOR CAR VALUE

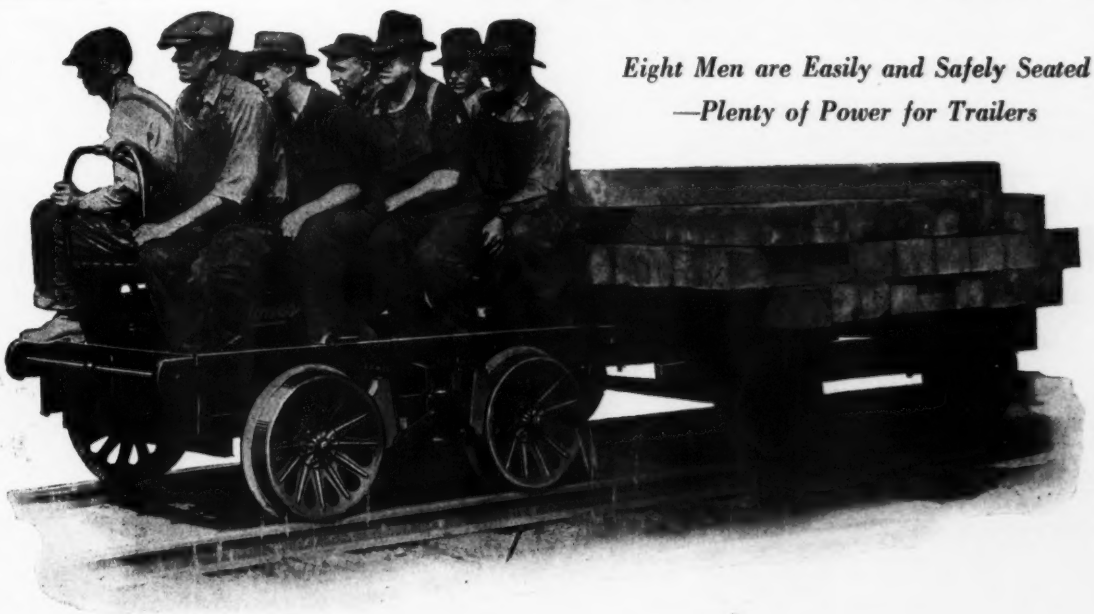
LOWEST FIRST COST

LOWEST COST OF OPERATION

LOWEST COST OF REPAIRS

GUARANTEED PERFORMANCE

SPECIFY Casey Jones An investment in permanent satisfaction

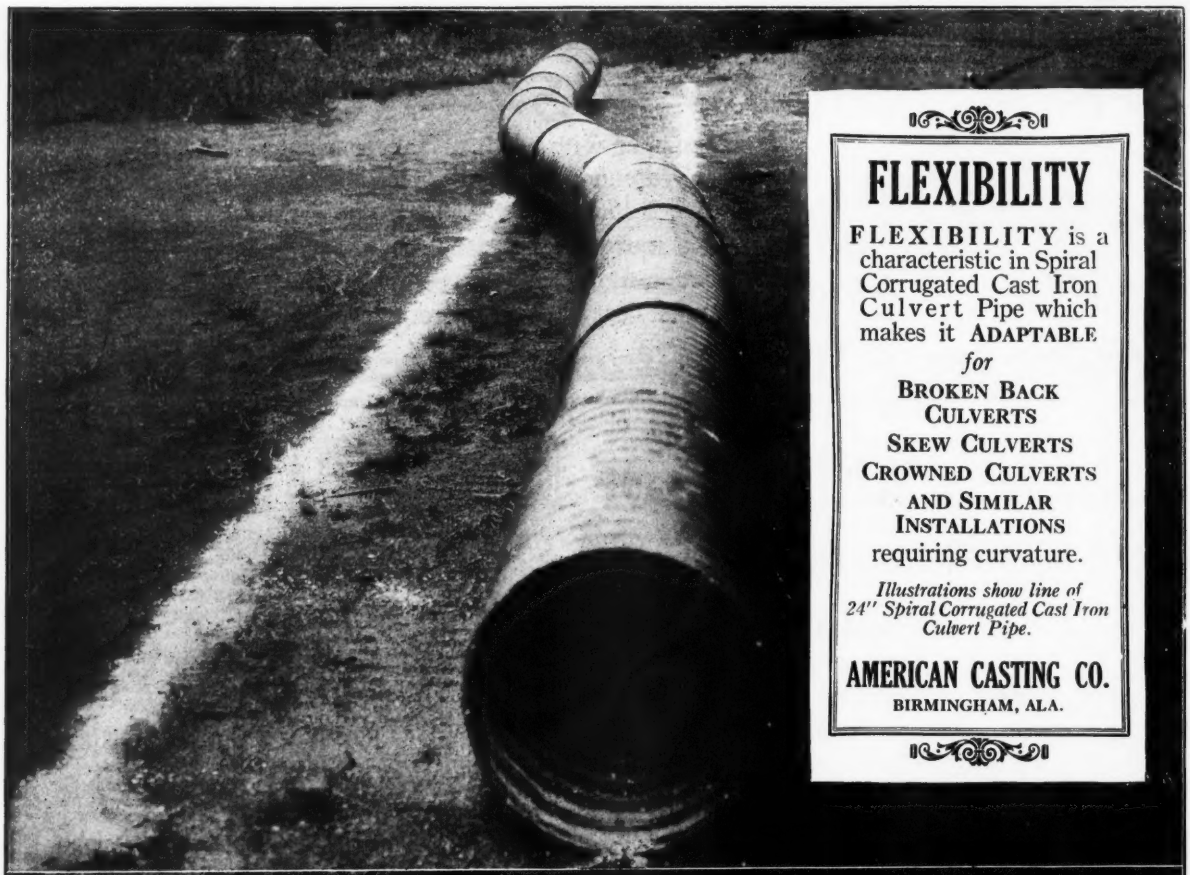


Eight Men are Easily and Safely Seated —Plenty of Power for Trailers

NORTHWESTERN MOTOR COMPANY, Eau Claire, Wis., U. S. A.

Casey Jones REG U.S. PAT. OFF.

MANUFACTURERS RAILWAY AND MOTOR CAR EQUIPMENT



FLEXIBILITY

FLEXIBILITY is a characteristic in Spiral Corrugated Cast Iron Culvert Pipe which makes it **ADAPTABLE** *for*

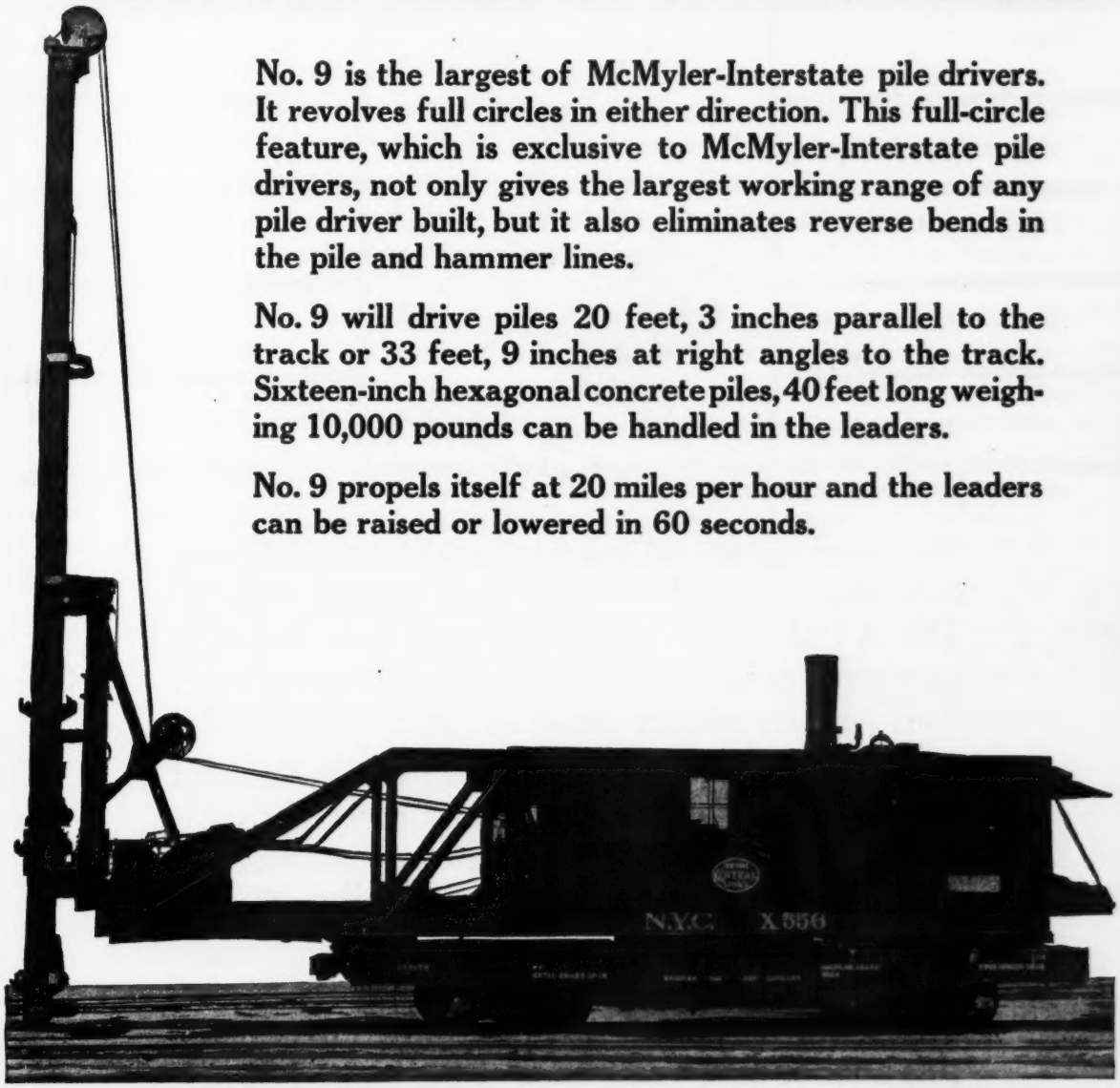
BROKEN BACK CULVERTS
SKEW CULVERTS
CROWNED CULVERTS
AND SIMILAR INSTALLATIONS
requiring curvature.

Illustrations show line of 24" Spiral Corrugated Cast Iron Culvert Pipe.

AMERICAN CASTING CO.
BIRMINGHAM, ALA.

No. 9- a Full Circle Pile Driver

WITH A SIDE REACH OF 33 FEET, 9 INCHES



No. 9 is the largest of McMyler-Interstate pile drivers. It revolves full circles in either direction. This full-circle feature, which is exclusive to McMyler-Interstate pile drivers, not only gives the largest working range of any pile driver built, but it also eliminates reverse bends in the pile and hammer lines.

No. 9 will drive piles 20 feet, 3 inches parallel to the track or 33 feet, 9 inches at right angles to the track. Sixteen-inch hexagonal concrete piles, 40 feet long weighing 10,000 pounds can be handled in the leaders.

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Railway
Engineering and Maintenance

Volume 21 November, 1925 Number 11

REPORTS SHOULD NOT BE A BURDEN ON THE FOREMEN

THERE IS a considerable difference of opinion among supervisory officers with respect to the character of reports to be made by foremen. On the one hand there are those who have foremost in their minds the need of cost information more complete than that to be obtained from the regular time and material reports prepared to meet the needs of accounting. On the other hand are those who are keenly alive to the difficulties experienced by many foremen in preparing anything but the simplest character of reports, and who contend that clerical work may become a source of anxiety and worry to the foreman because of their lack of education and that a man who has been disciplined for poor paper work may easily arrive at a state of mind in which his efficiency in his real work, that of directing his men, is definitely decreased. Better cost data on maintenance of way work are generally necessary but in endeavoring to develop a system of reports designed to afford more complete information the limitations of the average foreman as an accountant should be kept definitely in mind.

SOME OF THE ROADS ARE OVERLOOKING AN OPPORTUNITY

THE FORTY-THIRD annual convention of the Roadmasters' Association and the thirty-fifth annual convention of the Bridge and Building Association have now passed into history. Both were successful in point of attendance, character of programs and value of information brought out in the reports, papers and discussions.

Through their long existence these associations have established enviable records for constructive service. For this reason it is surprising to note the wide variation in the interest taken in these organizations by different roads. Thus, more than 30 engineers and roadmasters from one middle western road attended the Roadmasters' convention at Kansas City, while there was not a single representative from the track department of another road of similar size and located in the same area. The same contrast prevails in the Bridge and Building Association, for there are 64 members of that association from one large road, while another system traversing the same general territory and with an even greater mileage has only 7 representatives.

This contrast raises a question regarding the reason for the failure to recognize the value of these organizations to the men supervising work of the character covered by the reports. It may also be questioned whether the interest taken in these organizations may not be a measure of the alertness of the supervisory officers in informing themselves regarding developments in their branches of railway service. It is difficult to see how a progressive man can associate with a couple of hundred men of similar training and responsibility and can listen to reports and discussions on problems confronting him in his routine work wthout gathering ideas which can be applied to his own work with value. On the other hand, it is doubtful whether a lack of interest in the experiences of other men similarly employed may not be an indication of stagnation which may cause that man or that road to fail to keep abreast of developments.

We believe that it will be worth while for executive and system maintenance officers to make a check of the interest which their district and division supervisory officers are taking in the work of their respective organizations to ascertain whether their men and their roads are getting all of the benefit which it is possible for them to acquire through the work of these associations.

THE EXCEPTION PROVES THE RULE

ON ANOTHER page of this issue are presented abstracts of a number of reports of the Bureau of Safety of the Interstate Commerce Commission on train accidents which were clearly the results of defects in the track structure or of improper practices by employes of the maintenance of way department. They are given here to show the consequences of unsatisfactory conditions. Considering the number of trains run day in and day out on the railways, the number of accidents for which the maintenace of way department is responsible is small, a record which speaks well for the way in which the foreman and their superior officers are measuring up to the responsibilities placed on them. Accidents such as those reported in this issue may, therefore, be considered as exceptions which prove the rule, although they serve to emphasize the serious nature of the responsibilities and for this reason comprise a valuable object lesson.

MAKING THE MOST OF PRIZE AWARDS

IN PREPARING for an annual track inspection, which serves in part as the basis for awarding prizes to foremen and supervisors, the officers on one road recently discussed the idea of asking one or more of the foremen on each subdivision to ride on the inspection train, but upon investigation they found that some of the foremen did not take kindly to this suggestion because they did not like to lose the time from their gangs at what was to them an exceedingly critical period. No better demonstration can be offered of the spirit that is engendered by these inspections and the award of prizes.

It happens that the road in question is one which pursues an unusually careful plan for determining the prize winners, in that labor costs and an accurate measure of the riding qualities of track, as well as an inspection of

policing, ditching, etc., are considered in arriving at the award. It is not a plan under which one could say that the prize winner had "the prettiest rough-riding track he had ever seen." To derive the full benefit from any system of awards, the determination must be fair. While staying strictly within the limits of practicability it should take account of differences in conditions under which the several sections and supervisors' subdivisions are maintained. Furthermore, the incentive as measured by the nature of the award should be sufficient to make genuine efforts worth while.

THERE IS NECESSITY FOR IMPROVEMENT

MUCH publicity has been given to the splendid record made by the railways in recent years in the reduction in the number of accidents to employees. The progress made has been notable and has been worthy of the highest commendation. In the face of this progress the report presented at the Bridge and Building Convention, at Buffalo, in which it was shown that the accidents to employees in the bridge and building department have failed to show this decline and in fact actually show a tendency to increase, comes as a shock. It indicates the necessity for an awakening of employees in this branch of railway service to the importance of this subject and to the necessity for supervisory officers giving more attention to this subject. That improvement is not impossible is demonstrated by the statement made by the chairman of the committee that the bridge and building department of the Duluth, Missabe & Northern went through the entire year of 1924 without a single reportable injury.

99.9 PER CENT SERVICE

During the first eight months of this year 38,959,388 cars were loaded with revenue freight, a daily average of 139,140. During the same period the average daily shortage of cars requested by shippers was 123, and in three weeks in this period there was no report of any shipper failing to receive a car of the type he desired on the day he desired it. In other words, in this eight-months' period the shippers of the United States received better than a 99.9 per cent perfect car service. At this rate a shipper who loads a car every working day will be disappointed only once in 3 1-3 years. When one considers the diversity of types of equipment requested and furnished and the wide area of travel of these cars, it is doubtful if any industry of equal magnitude can be found that renders a service approaching this degree of perfection. This is the part that transportation is playing in our industrial life today. It is a record in which every railway employee may take justifiable pride. It is also a record which is made possible only through united, loyal team work.

In general, employment in the mainteance of way department has not been considered as hazardous as that in some other branches of railway service, particularly the transportation and the mechanical departments. Probably because of this fact less attention has been given to the promotion of safety campaigns in that branch of the service. However, the work in the bridge and building department is sufficiently hazardous and accidents are sufficiently numerous here to warrant more consideration and the fact that they are not decreasing should result in more consideration being given to this subject, now that attention has been called to it.

A safety campaign is primarily an educational campaign. It depends for its success principally on the enlistment of the interest of the men. Their attitude is in large measure a reflection of the interest taken by supervisory officers. The initiative rests with them and for this reason the record cited above is a reflection on them.

An officer in charge of men has no greater responsibility than the protection of the lives of those working under his direction. Much of the work of the bridge and building department, and in fact of the entire maintenance of way department, possesses a considerable element of hazard. Men are frequently required to work on high structures and in proximity to trains. Yet most accidents are avoidable and are the result of carelessness on the part of the workman himself or of his associates. Supervisory officers should enlist the interest and co-operation of their men in protecting themselves, and where educational measures are not effective they should not hesitate to apply discipline to protect the associates of a careless workman.

THE VALUE OF EXHIBITS

IT IS DOUBTFUL if the average railway man who attends a convention appreciates the value of the exhibits which are commonly presented in connection therewith. These exhibits are not infrequently regarded merely as expedients adopted by manufacturers to promote the use of their products. Yet an exhibit can be and not infrequently is so presented as to have an educational value approaching that of the convention itself.

An exhibit is a sales measure and must be so charged by the manufacturer. He participates in it because it affords him an opportunity to bring his products to the attention of present and prospective users at a fraction of the expense that would be required to make individual calls on them at their various offices. This does not, however, lessen the value of the exhibit to the railway man. By bringing together competing manufacturers it affords him an opportunity to compare their products and to determine those best adapted to his needs. An exhibit also affords him an opportunity to inform himself regarding recent developments and to learn of new materials and equipment at a much earlier date than might otherwise be possible. An exhibit properly prepared is, therefore, of much educational value to the alert railroad officer and adds to the benefit of the convention to him. As this becomes more generally realized attendance at the convention itself is stimulated, for it may frequently happen that it may be the turning point in favor of attendance at the convention on the part of a railway man who is otherwise undecided. Because of this possibility of an exhibit stimulating attendance at a convention, a responsibility is placed upon exhibitors themselves to so present their products that their exhibits may be of the maximum value to their customers. This brings increased returns to them because it attracts more men to their exhibit than would otherwise see it.

The value of an exhibit in stimulating attendance at a convention is demonstrated in a striking manner by the National Railway Appliances Association whose exhibit each March attracts many men to Chi-

cago who would not otherwise come for the convention of the American Railway Engineering Association alone. The exhibit of the Track Supply Association has likewise stimulated attendance at the conventions of the Roadmasters' Association for it has also been highly instructive in character. It is encouraging that the Bridge and Building Supply Men's Association, which has of late years confined its exhibits largely to models and literature, decided at its exhibit in Buffalo last month to encourage its members to present more extensive displays of their materials in the future, for with the rapidity with which developments are being made in this field it is possible to present an exhibit of great value to railway men and therefore to the manufacturers themselves.

Exhibits properly prepared are of great educational value to railway men. Because of this fact they can also be made of sales promotional value to the manufacturers. They should, therefore, be encouraged and stimulated by railway men and manufacturers alike.

THE VALUE OF A YARD STICK

NO MAN DOES his best without a goal or objective. It is only when he endeavors to reach a certain mark that he applies himself most efficiently. This is as true in one's routine work as in an athletic contest. Yet it is only recently that this principle has come to be realized in industry and it has not yet been accepted to any great extent in railway service.

As far as maintenance of way work is concerned this plan was developed in considerable detail in the standard track work system employed by the Baltimore & Ohio for several years prior to federal control, but abandoned after the government took over the roads. Some two or three years ago this plan was developed in a somewhat different form on the St. Louis-San Francisco. In the September issue we published an article by C. P. Hoff, assistant engineer on the staff of the chief engineer of the Frisco, describing the principles of this system and the manner in which it is being employed to determine reasonable costs for various operations and to compare these costs with those actually developed on different divisions. In this issue we present another article by J. M. Sills, a division engineer on the St. Louis-San Francisco, describing the application of this system locally on a division to afford a basis of comparison between the operations of different gangs.

In studying any system for comparing the performances of different gangs one must not lose sight of the fact that the first essential is that the work shall be well done. Of late years, however, it has also come to be realized that it must be done economically. But the extent to which this latter requirement is met can only be determined by a comparison with some standard or, in other words, by measurement with a yard stick.

The method employed by the Frisco has been, first, to determine the average cost of work done by the different gangs. After reconciling differences in the method of arriving at the costs, the figures show those gangs whose unit costs are high, indicating the points that should receive first consideration in a campaign to reduce costs. By studying the methods of those gangs whose costs are low, information can be gained which can be transmitted to other gangs and enable them to effect similar economies.

In general, it will be found that employees are desirous of improving their work and of reducing its costs if their attention is called to the fact that it is high. The principal value of a system like that developed on the Frisco is that it shows each foreman and each supervisor how his operations compare with those of his fellows. The mere fact that this information is compiled and distributed among them will stimulate the men whose costs are high to efforts to improve their records. When this information is accompanied by intelligent study of the methods of the more successful gangs, it is possible to reduce the figures still further.

The first step in any campaign to reduce costs is to determine where the leaks are. Once these are discovered the problem is half solved. Maintenance costs have suffered because of the lack of comparative data in the past. It is to be hoped that more railways will realize the value of information of this character in enabling them to determine the sources of the greatest leaks and also to afford the means for the stimulation of healthy, constructive rivalry.

BE SURE YOU'RE RIGHT—THEN GO AHEAD

IT IS NOT so many years since more than one engineer was credited with saying that he saw no merit in the practice of breaking stone into little pieces for the sole purpose of pasting them together again with cement. The obvious answer to this comment is that it is cheaper to do this than to cut the stone to the desired shape and size from the native rock. This is the primary reason for the marked growth of the Portland cement industry and the enormous development in the use of concrete and represents a notable illustration of the changes wrought during the course of this industrial period. Rock crushing, sand and gravel pit operation, cement making and concrete mixing are conducted almost entirely by machinery, whereas stone cutting is still largely a manual operation.

There are, of course, other advantages of concrete over stone masonry, of which the most important is that with concrete it is possible to build monolithic construction to any desired shape, while application of the science of reinforcement has made possible with concrete what was impossible with stone, namely, the slender column, the flat slab and the beam.

Development in the use of concrete has led to its application in ways necessitating the sacrifice of some of its inherent advantages for the purpose of taking greater advantage of others. For example, the advantage of monolithic construction is discarded in pre-cast concrete for the purpose of developing the economy and convenience possible with separately cast units. In other cases where no reinforcement is required the pre-cast unit is substantially the equivalent of cut stone, its advantages being derived entirely from the difference in cost. There are also cases where pre-casting offers no advantage other than the solution of a difficult construction problem, as for example, the independent casting of track slabs where construction in place would have resulted in a serious predicament because of inadequate head-room for the placing of falsework stringers to carry traffic during construction.

However, because it has been found economical or desirable to pre-cast certain forms of concrete it does not follow as a matter of course that it will be profitable to pre-cast concrete units for some other purpose. A thorough analysis of each case must be made on its own merits, which will require definite answers to ascertain basic questions such as the following: Why use concrete rather than stone, wood or steel? Will pre-cast or cast-in-place units best serve the purpose? Which will be the cheaper, taking into account all the factors, including transportation, plant charges, interference with train operation etc.?

Letters to the Editor

GETTING A MOTOR CAR IN THE CLEAR

Ruston, La.

To The Editor:

I see good advice in almost every issue of *Railway Engineering and Maintenance* regarding the operation of motor cars, but so far I have not seen any information as to the quickest and safest method of getting the motor car off the track. It is sometimes necessary to get cars off very quickly to keep them from being struck and a man or two crippled or killed.

I always try to keep two of the biggest and strongest men I have on the end of the car that is to be picked up when taking it off, whether it is the front or the rear end. These men are told that that is their job to lift their end of the car off when it is stopped and the rest of the gang know that they are to get the back end off and push the car in the clear. Sometimes when we have eight or ten men we use a push car behind the motor car in which event we assign one man to uncouple the push car and he knows that he is depended upon to do this. I have been very busy for the past 90 days organizing my men to prevent the car from being hit, on account of laying off and then putting on men that have been cotton pickers, soda clerks, etc.

It is just as necessary to have a gang organized to handle their motor car as for any other task. A number of motor cars have been hit by trains in the past year; in most cases this would not have happened if the gang had been organized properly and had known how to get the cars off. When four or six men run to one end of a car to pick it up, one falling over the other, that car is likely to be knocked off the track if the train is close and does not stop.

D. D. Gay,
Section Foreman, Chicago, Rock Island & Pacific.

LAYING ROOFING OVER OLD SHINGLES

Philadelphia, Pa.

To the Editor:

My attention has been drawn to an answer to a question on the laying of roofing over old shingles prepared by N. H. LaFountain, general supervisor of bridges on the Chicago, Milwaukee and St. Paul, and published in the October issue of *Railway Engineering and Maintenance*, page 418, in which he states that it has been his experience that the laying of roll roofing or composition shingles over old wooden shingles is not good practice for the reason that the surface of the old wooden shingle roof is so rough that it is practically impossible to nail a new roofing properly without damaging it.

While it may not be desirable to lay a light-weight roofing over old wood shingles where it has not been possible to get a comparatively smooth roof deck after nailing down the loose ends of the old shingles, and while it is true that many roll roofing manufacturers suggest that their roofing should be laid on a clean, smooth surface to secure the best results, it is also true that a heavy-weight roll roofing can be laid successfully without fear of damaging the roofing. We do not believe that Mr. LaFountain was familiar with the fact that shingles are being made which are adaptable particularly for this method of re-roofing and that millions of squares of these shingles have been applied successfully by roofing contractors in all parts of the United States within the last few years.

When these shingles are to be laid over old wood shingles, the butts of the old shingles that are badly curled should be nailed down. If the warping or curling of the old shingles is so serious that the shingles cannot be flattened by nailing, the protruding portions should be cut off with an adz. In some instances it may be desirable to lay a course of wood lath, similar to those used for plastering, just below the butts of each course of the old wood shingles and nailed securely. This tends to provide a solid course of new lumber on which the new shingles can be nailed. In some cases where pronounced depressions cannot be overcome by these methods, the depressions can be filled and leveled successfully with an asphalt putty or roofing cement. Any of these methods of preparing old wood shingle roofs provides a relatively smooth surface upon which new shingles can be nailed.

At least one design of shingle, which is square except for a turned under corner and lays up to a hexagonal shape on the roof, includes a simple key device (a metal strap at the butt of each single) which locks the shingle tightly to those underneath. They are then nailed down 1½ in. from the right and left-hand corners of the shingle with 1½ in. nails so that they cannot be lifted and blown up by high winds, in this way overcoming the objection raised.

W. F. Hartzell,
Advertising Manager, The Barber Asphalt Company.

STRING LINING CURVES

Charlottetown, P. E. Island.

To the Editor:

The letter by Charles Weiss in the October issue on the string lining of curves prompts me to outline our custom with string lining. As our section foremen are not experts in mathematics, we supply each of them with a blueprint showing the degree and super-elevation of all their curves. We also supply them with a 62-ft. line, the middle ordinate of which is approximately one inch for each degree of curve. When I find a curve is not riding well I have the foreman use his line to measure the middle ordinate in inches at intervals of 31 ft. along the curve and mark it on the rail. If a curve is, say, 8 deg., according to the blueprint and he finds that his chalked figures are 6 in. at one place and 10 in. a couple of rails further on he knows that at the 6-in. point he must line his track out 2 in. and at the 10-in. point he must line it in 2 in. He moves the track in and out at these points, measuring with his rule, and then lines between these points by eye. He then repeats this a second time with the line, which generally gives a good uniform curve.

J. J. Bethune,
Roadmaster, Canadian National.

[This is an old rule which has been used extensively and, as stated by Mr. Bethune, its use requires considerable lining by eye and more or less readjustment after the first trial. That this is necessary is accounted for by the fundamental principle that the throwing of a curve at one point to flatten it has the effect of sharpening the curve on each side of this point, and vice versa. The truth of this can be quickly checked by experiment. For example, if a 62-ft. cord is used and the track is thrown at one point to increase the ordinate one inch, this will have the effect of increasing the ordinate one-half inch at the 31-ft. point on either side of the first point. In view of this students of string lining are in common accord that any method used must be applied to the curve as a whole and that the method must take account of the effect which the throwing at one point will have on the ordinates at other points.—Editor.]

Frisco Studies Various Methods of Making Tie Renewals

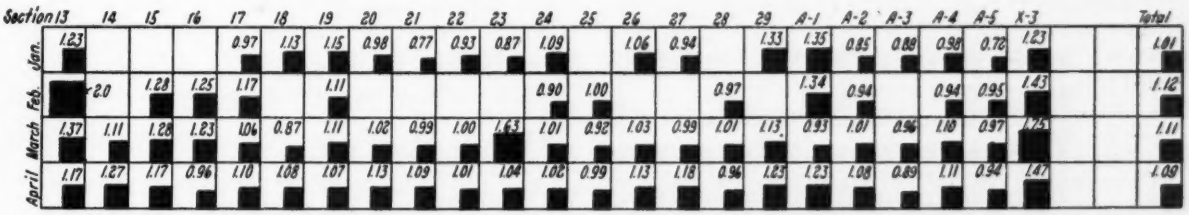
Comparative Cost System and Time Studies Form Basis for the Selection of Most Effective Practices

BY J. M. SILLS

District Engineer, St. Louis-San Francisco, Springfield, Mo.

COMMENCING at the beginning of 1924, a series of experiments has been conducted on the Eastern division of the St. Louis-San Francisco with the object of reducing maintenance costs by the application of scientific methods and the education of employees in their use. Thus far, the work has been concentrated on a study of the situation prevailing prior to July 1, 1924, and on the application of new methods subsequent to that date, particularly in the installation of ties, as that operation consumes a large proportion of the maintenance appropriation.

Based on our experiences we can safely say that with an adequate engineering staff, properly trained, we can materially reduce all maintenance expenditures. In other words, we can obtain much greater efficiency in the handling of all maintenance work by the careful study and the scientific, practical application of better methods based on complete analyses. In the past, such matters have been left largely in the hands of roadmasters, who have neither the time nor the equipment to go into the scientific detail necessary to get high efficiency. The experiments thus far must be considered in the nature of a progress report with the object eventually of increasing efficiency in all departments of track work.



Tie Renewal Chart for 23 Gangs Giving Number of Ties Inserted per Man-Hour, Foreman's Time Included

Based on Daily Reports

In order to make possible the study of costs, we found it necessary first to install a daily system of reports from track foremen in the field to provide the necessary data on current production and costs. This report system was described in an article by Carl P. Hoff, appearing on page 345 of *Railway Engineering and Maintenance* for September, 1925. Prior to the actual start of the experiments in tie installation, these reports were studied carefully and a fairly accurate set of costs was obtained.

For the last six months prior to starting this experiment, in other words, from January 1, 1924, to July 1, the cost of installing ties in chatts and gravel ballast on the Eastern division averaged 35.6 cents, or 41.5 cents in the terminals and 35.1 cents outside. The cost of inserting ties in July, the first month of our experiments, averaged 32.1 cents for the division or 47.3 cents in the terminals and 31.9 cents outside. During August the cost was further reduced to 31.7 cents on the division as a whole or 38.8 cents in the terminals and 31.0 cents outside. During September the average cost was reduced to 29.8 cents for the division, 40.2 cents in the terminals and 28.8 cents outside.

No intensive effort has been made as yet to reduce the tie installation cost in the terminals. Our activities have been concentrated on the outside sections where the greatest saving can be accomplished in the shortest time. The experiments are being continued in 1925 and during this year we will give attention to the terminals and also to the branch lines and more of the sections where the ballast is gravel. Seven of the tests made last year were in gravel track while 16 were made in chatts. It is believed that we can reduce the averages considerably in both chatts and gravel during 1925 and lower the cost somewhat in the terminals by making an intensive study of the conditions.

It is interesting to note that the Eastern division has several large terminals, St. Louis, Newburg, Springfield and Monett, which hold up the average cost of tie installation in spite of reductions in the cost out on the line. Owing to certain fixed conditions costs are necessarily higher in terminals than out on the line. However, in spite of that fact, the average cost of tie installation during the month of August, 1924, was 31.7 cents while the average cost on the system for applying ties in chatts or gravel ballast during the same month amounted to 33.3 cents.

Change in Methods Reduces Costs

A few individual cases showing the most marked changes will be of interest. For example, on one section under a first-class, competent roadmaster, we found from the daily cost data that the average cost of putting in ties was 44 cents. After applying proper methods of installing the ties, but without any change whatever in the working conditions, this average cost dropped to 21.6 cents on the first day the test was made. The foreman in charge is an unusually hard worker, with excellent men of long experience, and yet the change in cost was very large owing to the fact that he had used a poor method of handling this work. This condition was found at many places.

In another case the section cost averaged 34 cents prior to the first test. On the first day's experiment, with the same working conditions, the cost fell to 19.9 cents.

On another section, with good average men, ties were put in at a cost of 18.1 cents, which remains the record on the division to date.

It should be made clear that in all of these cases the men did not work unusually hard and were in no wise worn out or unusually tired at the end of the day's work. In fact, in one case (the first mentioned above) they said voluntarily that they had actually done less work and felt less tired than usual at quitting time. It is an interesting side-light to note that in practically all cases the foremen and men took a deep interest in the attempts to improve their methods and co-operated wholeheartedly.

In all of these experiments nothing but first-class work was done. There was no slighting of the work to gain speed. In all of the cases handled the track was left in perfect condition as regards line and surface and dressing up at the end of the day. Any picking up of low spots or lining necessary in connection with the installation of the ties was taken care of as usual and the ballast shoulder left completely dressed so that no return trip to the job was necessary. In connection with all these studies and experiments, every man was clearly impressed with the idea that only first-class work would be accepted and that while we were interested in reducing cost, as a matter of fact cost was secondary to first-class work.

On the Eastern division, the conditions differ on different sections as regards the applying of ties, but as most of the work is done in either chatts or gravel, there is really a fairly comparable basis on which to work. Small-size gravel, fairly clean, differs little from chatts as far as the cost of tie renewals is concerned, but where very large gravel is encountered or where a great deal of mud has seeped up through the gravel, it is more expensive to install ties than in chatts or clean gravel of proper size.

Try to Discover the Best Methods

In making these practical experiments in the field, we started out with the idea of using not only our own methods, but also the best methods of every foreman. In that way we were able to determine the best methods of operation and to combine them into one complete practical method of applying ties, which would bring lower costs.

Therefore, in collecting the cost records, we worked out a large cost sheet on which the record of cost for each section was posted each month. After several months of this posting, the record showed clearly that certain sections were consistently running higher or lower in cost than others. A day was then spent in the field on each of these sections and the methods used by the high-cost foreman and by the low-cost foreman were studied in detail and charted from the stop watch data.

It was found that some of the variation in cost was due to variations in the methods observed by the foremen in reporting the time charged to tie renewals. For instance, some foremen considered the tie insertion complete when the new tie had been pulled in, and charged part of the time to spiking, gaging, surfacing, or dressing the ballast shoulder. Another foreman arbitrarily reported one tie per man per hour at such points as street or road crossings. Other foremen, when assisting other sections, reported all ties as put in by their own gang, the other foreman doing likewise, thus cutting the cost in two.

When ties are trucked short distances, on account of improper distribution, the time should be charged to tie insertion, but where the ties had not been distributed at all, as in terminals, and had to be trucked a considerable distance, this trucking was not charged against tie insertions. On account of the variety of ways of disposing of old ties, this time was excluded. This covers hauling away the ties, piling and burning them or splitting them into fence posts.

However, after all accounting adjustments of this kind were made with the co-operation of the accounting department, roadmasters and foremen, the costs were placed on a fair, comparable basis, the net result being a small raise in the average cost.

Stop-Watch Comparison of Methods

Pulling Spikes

1. No time charged. Foreman pulls all spikes.
2. 1.8 min. per tie. One man goes ahead and pulls spikes.
3. 2.7 min. per tie. Each two men pull their own spikes. Foreman assists.
4. 1.0 min. per tie. One man goes ahead and pulls spikes. Foreman assists.

Digging Out at Side of Old Tie

1. 13.7 min. per tie. First two men dig out for next two men.
2. 6.0 min. per tie. Each two men dig out their own ties.
3. 5.5 min. per tie. Each two men dig out their own ties. Foreman assists.
4. 6.0 min. per tie. Each two men dig out their own ties.

Pull Out Old Tie and Insert New Tie

1. 8.2 min. per tie. First two men pull out old tie and insert new tie for next two men.
2. 5.5 min. per tie. Each two men do their own work. Foreman assists.
3. 6.0 min. per tie. Each two men do their own work. Foreman assists.
4. 5.8 min. per tie. Each two men do their own work. Foreman assists.

Tamping

1. 13.5 min. per tie including plating and dressing. Second two men assisted by foreman.
2. 4.8 min. per tie. Each two men tamp their tie. Foreman nips.
3. 6.8 min. per tie. One man nips and one man tamps. Foreman assists.
4. 3.9 min. per tie. Each two men tamp their tie. Foreman assists.

Spiking

1. 6.5 min. per tie. Second two men spike for first two men.
2. 3.8 min. per tie. Two men spike all ties near close of day.
3. 2.9 min. per tie. Two men spike all ties near close of day, assisted by foreman.
4. 4.3 min. per tie. Two men spike all ties near close of day.

Dressing up Ballast

1. See "Tamping."
2. 3.3 min. per tie. Two men and foreman near close of day.
3. 3.8 min. per tie. Two men and foreman near close of day.
4. 3.9 min. per tie. Two men and foreman near close of day.

Plating

1. See "Tamping."
2. 0.6 min. per tie. One man and foreman ahead of spikers.
3. No plates used.
4. 0.8 min. per tie. One man and foreman ahead of spikers.

Adzing

1, 2, 3, and 4, foreman does all adzing.

Totals

Case	Test Totals Time Consumed	Cost per tie	Totals for Five Months Average cost per tie	Number of ties inserted
1	41.9 min. per tie	$0.320	$0.444	369
2	25.8 min. per tie	0.203	0.230	339
3	27.7 min. per tie	0.226	0.304	461
4	25.7 min. per tie	0.194	0.444	369

Make Time Studies

Stop watch tests on different gangs, showing the exact movement of each individual, were then made in complete detail. We watched the methods of the men and

combined, as stated before, the good features we found, finally arriving at a sort of standard method which we have since used with only small changes in all of these experiments. For purposes of information in this connection, a separate sheet showing stop watch comparisons of different methods with different men under practically the same conditions, was compiled as shown in the table. These sheets show considerable variation in the several operations. Case 4 is really an experiment based on the conclusions arrived at by a study of Cases 1, 2, and 3. Therefore, we will examine Cases 1, 2, and 3 first.

Pulling spikes: Two men pulling spikes at one tie get in each other's way and time is lost in Case 3 by dropping shovels and picking up claw bars for each tie. From the time consumed per tie we may conclude that Cases 1 and 2 do not have the best method. Of course, since the foreman's time is not charged in these stop watch experiments, he will cut down the average time whenever he assists. This, however, would have no effect on the ultimate methods used as the foreman's time was taken into consideration and charged when the actual cost data were made up in all of these cases. We do believe, however, that in the future the foreman can assist to the best advantage if he is employed in a position where he can also supervise and we conclude, therefore, that Case 2 has the best method.

Digging out at side of old tie: Something is wrong with Case 1. Upon examination we find that the two men are digging out much too deep. The foreman is not with these two men at any time and we conclude again that his time would be better spent here than ahead pulling spikes. We find also that the system of handling men in Case 1 eliminates the competitive element. We conclude that Case 3 has the best method.

Pulling out old tie and inserting new ties: Exactly the same comment as applied above to Case 1 holds here. Cases 2 and 3 used the same methods. We see that Case 3 has lost the advantage gained in digging out—probably due to the distribution of the foreman's assistance.

Tamping: On account of the way Case 1 handles the plating and dressing, these operations cannot well be separated. However, the total time spent on the three operations exceeds the total time used in Cases 2 and 3 for the same work and we may conclude that the method in Case 1 results in loss of time. We see that the best time is made when the foreman nips and both men tamp and conclude that Case 2 has the best method.

Similarly we continue through the remaining operations. We see that No. 3 gains time over No. 2 in spiking—probably due to the foreman's assistance, but loses a part of it again in dressing up ballast. Also we must note that Case 3 has no plates to apply. There is really little room for choice between the two methods for the remaining operations.

Summing up, we conclude that the method in Case 1 is entirely undesirable and No. 2 is best. This is borne out by the total time consumed per tie for the three sections. No. 3 loses time pulling spikes and tamping.

Result of Tie Renewal Tests During July, August and September, 1924.

		TEST			Previous Record Jan. 1 to test.			Subsequent Record Test to Sept. 30.		
Section	Kind of ballast	No. ties	Total cost	Ave. cost	Ties	Total cost	Ave. cost	Ties	Total cost	Ave. cost
14	Gravel	40	$10.86	.271	723	$243.56	.333	492	$155.92	.316
16	Gravel	22	7.24	.329	766	293.17	.383	224	86.00	.383
23	Gravel	37	12.22	.330	1277	485.91	.381	408	113.49	.278
31	Gravel	31	10.93	.353	353	139.62	.396	269	84.02	.312
31	Gravel	40	10.43	.260	558	205.01	.368	64	18.31	.287
34	Gravel	41	13.12	.320	334	107.44	.322	41	13.12	.320
35	Gravel	60	13.86	.231	225	78.98	.351	60	13.86	.231
37	Chatts	38	8.14	.214	486	158.74	.327	156	35.95	.230
40	Chatts	70	17.04	.243	705	238.48	.338	232	74.55	.321
42½	Chatts	60	10.86	.181		none		189	32.85	.174
44	Chatts	38	7.69	.202	522	162.75	.312	285	78.13	.274
49	Chatts	38	8.35	.220	552	159.38	.289	38	8.35	.220
50	Chatts	60	13.57	.226	732	225.57	.308	60	13.57	.226
51	Chatts	50	11.42	.228	437	111.86	.256	634	177.25	.279
52	Chatts	60	11.92	.199	634	207.60	.327	448	120.26	.268
57	Chatts	51	14.78	.290	62	27.60	.450	196	73.81	.376
58	Chatts	44	11.71	.266	176	82.17	.467	375	130.20	.348
59	Chatts	51	10.64	.208	640	208.62	.326	462	112.60	.244
60	Chatts	65	12.67	.195	587	143.26	.244	1266	317.41	.250
62	Chatts	59	15.73	.266	1049	381.18	.382	627	206.31	.328
63	Chatts	88	19.00	.216	678	296.65	.438	552	151.59	.275
64	Chatts	36	8.14	.226	868	309.56	.357	500	136.69	.273
65½	Chatts	33	7.74	.234	791	312.36	.394	312	63.38	.203
Totals		1112	268.06	.241	13155	4579.47	.348	7891	2217.62	.281

Per cent in reduction in cost since test—19.3.

Testing the Proposed Method

In order to put the conclusions to a practical test, ties were inserted as shown under Case 4 by the same section gang reported under Case 1. Conditions were practically the same and the location was only a few telegraph pole panels removed from the first test. The methods followed were based on conclusions arrived at as above and corresponded closely to those used in Case 2.

The result showed a slight variation in time from Case 2 with respect to the different operations. However, the variations were not greater than might be attributed directly to the distribution of the assistance by the foreman and the net result was almost the same, for there was only one-tenth of one minute difference in the total time used per tie. Other tests were made with gratifying results.

Comparative Cost of Tie Insertions in Chatts or Gravel Ballast on The Eastern Division, 1924.

		Division	Terminals	Outside	System
Jan. 1	Ties	32,840	2,034	30,806	
to	Cost	$11,650.86	$844.77	$10,805.09	
June 30	Ave. cost	.356	.415	.351	0.349
	Ties	12,747	166	12,581	
July	Cost	$4,094.54	$ 78.76	$4,015.78	
	Ave. cost	.321	.473	.319	0.332
	Ties	15,443	1,263	14,180	
	Cost	$4,894.89	$490.56	$4,404.33	
August	Ave. Cost	.317	.388	.310	0.333
	Ties	11,315	1,245	10,070	
	Cost	$3,377.70	$499.95	$2,877.75	
September	Ave. cost	.298	.402	.288	
	Ties	6,950	728	6,222	
	Cost	$1,983.88	$253.92	$1,729.96	
October	Ave. cost	.285	.349	.278	0.318
	Ties	11,566	264	11,302	
	Cost	$3,034.15	$73.98	$2,960.17	
November	Ave. cost	.262	.280	.262	0.325
	Ties	3,898	98	3,800	
	Cost	$1,077.52	$36.21	$1,041.31	
December	Ave. cost	.277	.369	.274	0.328

From the above it is clear that the method of tie installation has a very direct bearing on the cost. It is, of course, self-evident that much will depend on the ingenuity and industry of the foreman and the willingness, skill and industry of the men. We have had the best co-operation from the men and the foremen, except in a few isolated cases. We have handled the entire study with the idea of getting co-operation rather than of trying to force anybody to conform to our plan, the idea being that intelligent supervision is based on the education of the men rather than on the driving of them.

The Standard Method

The method we have finally adopted and have put into effect in many places, but not universally, is as follows:

1.—The indicating of the ties to be replaced is done during the annual inspection, subject to the exercise of the foreman's judgment when the actual renewals are made. A record is kept of the exact number of ties required on each mile. This record is made at the time of the annual tie inspection.

2.—The unloading and distribution of ties can be handled effectually by unloading from trains if the road-

master and section foreman have the record with them. The section foreman, of course, has an accurate idea of just what ties should be unloaded on each mile. His judgment in connection with the roadmaster's supervision by means of written record gives us a very good distribution from cars. The only trouble experienced with this method arises from ties rolling down the bank, resulting in considerable expense in bringing them back. In keeping the cost of installing ties, we assume that the ties are properly distributed ahead of time. It is impossible to get away from a small amount of rehandling of ties on push cars or dragging them along the rail but we try to keep this down to a minimum.

3.—In pulling spikes, one man should pull the spikes ahead of the gang. It is usually best not to pull very many at one time, as where renewals come side by side enough spikes must be left in to keep the track safe.

4.—The remainder of the work should be divided into two sets of operations. The first includes digging out, pulling out the old tie, pulling in the new tie and tamping. Two men, never more, should be placed at each tie. If there is an odd man he may pull spikes, dig out and help nip, his exact duties depending upon the size of the gang. He should be one of the best men in the gang. For small gangs, the foreman should do all of the nipping. This puts him in a position where he can supervise the work and still be helping at the actual labor. If the foreman is not on hand to nip, one of the men should nip and another tamp the ends enough to hold the tie, after which both finish tamping. Each pair of men should work not closer than half a rail length apart. Working too close together not only causes loss of time, but it is dangerous. On the other hand, working reasonably close together improves the morale of the gang, creates a friendly spirit of competition and makes closer supervision possible.

The second set of operations includes plating, spiking and dressing up ballast. For small gangs, it is best to leave the second set of operations until near the close of the day's work, unless the ties are so widely scattered that this is impracticable. This allows the new ties to settle under traffic before spiking and dressing. Spiking on a solid bed is easier for the men and dressing ballast after the tie has settled eliminates the depression otherwise formed by the tie settling.

5.—Digging out the old tie. Dig out at the side of the tie and through the shoulder on the side on which old tie is to be pulled out. If the old ties are to be burned, it is usually best to pull them out on the side away from the telegraph wires. The trench thould be dug out about one inch deeper than the bottom of the old tie, or just as little as experience teaches is necessary to remove the old tie. It will be found that the trench must be dug a little deeper for rock or coarse gravel ballast. Drive the old tie over into the trench. Remove the tie plates. Pull the tie out. If two or more ties are coming out side by side, remove in pairs.

6.—Pulling in the new ties. Clean out the trench for the new tie, handling the ballast just as little as possible. Notice whether the new tie is large or small and clean out accordingly. Be sure to dig out the shoulder low enough so that the front end of the tie does not plow as it is pulled in. Adze the tie if necessary to fit the rail.

7.—Tamping. Tamp the tie snugly against the rails, nipping the tie while tamping. Do not spring the rail unless there are no plates. Plates should be placed conveniently at hand on the ends of the ties. If it is necessary to spike a tie to keep the track safe, put on plates, spike and tamp to the rail without springing. If no plates are to be used, the rail should be sprung with the nipping bar while the tie is being tamped. Use a nip plate for a heel. Where no plates are used, the foreman should do the nipping. Extreme care should be taken not to raise or spring the rail too much—just enough to allow settling to the old level.

This completes the first set of operations. The men continue digging out, pulling in, and tamping, until the foreman believes it will take the rest of the day to complete the spiking and dressing.

8.—Distributing spikes. One man should go ahead of the spikers and distribute the spikes.

9.—Plating. The foreman and one man take a jack, bar and shovels. The foreman places the plates under the rail while the man springs the rail with the jack just enough to let the plate under. This raises the track the thickness of the plate and allows for settlement to the original level. At joints or an occasional missing plate, spring the rail about the thickness of the plate and retamp any new ties that were plated and spiked for safety.

10.—Spiking. Two men follow the spike distributor and platers and spike one side, then spike the other side to gage. Unless the ties were inserted very close together, it saves time to have the men spike both sides as they go.

11.—Lining. If many ties were taken out to the rail length, it may be that the track will be left slightly out of line. If so, it should be lined and the time used charged to inserting ties. Lining is seldom necessary.

12.—Dressing up. The men distributing spikes and placing plates will have finished long before the spikers and will then fall back and dress up. Centers should be dressed up first, then the shoulders. If the spikers get through spiking before the ballast dressers catch up, they help dressing up.

It is important that the old roadbed be disturbed as little as possible. At places where ties are renewed almost out of face, it is best to put in only a part of the new ties at one time. Enough ties should be left in the track to hold the track to line. This is especially important where there is danger of the track "bucking" out of line due to expansion. Also it is cheaper to put in the ties this way.

Ties are put in the cheapest where two ties come out side by side, so that only one trench is necessary. When more than two ties come out, it becomes necessary to handle the ballast more. Also it may become necessary to plate and spike some of the ties to make the track safe, necessitating a change of tools, and later retamping when plates are placed on adjacent ties.

Many little points continually arise in connection with the handling of work of this kind which are important in the aggregate. It is especially important that the foreman, while taking an active part in the labor of putting in ties, be in position to supervise every detail of the work done by his men, otherwise a good and efficient job will not be obtained.

Everyone realizes that putting in ties, especially in hot weather, is hard work. It is, therefore, necessary that the men be given every possible opportunity under the circumstances to keep cool and, therefore, good, fresh water of proper temperature should be provided. The water keg should be kept in as cool and convenient a place as is possible. Such little helps as throwing a saturated blanket or gunny sack over it, all enter into the cost of doing this kind of work. Many such expedients occur to the foremen and are used to much advantage by them. The necessity of using care and good common sense in handling men is, of course, self-evident in a general way, but everything done to educate the foremen to do things necessary along this line is important.

Australian Railways Try Cure for Spike Killing

JUDGING FROM a report by Colonel H. Cope, commissioner of the Western Australian Government Railways, the problem of spike killing is one which confronts railway men the world over. This report is of particular interest because it contains an account of a method being followed in Australia of filling enlarged spike holes in ties with a special preparation whereby it is possible to restore the spike-holding power of the ties. There is no evidence that this process has been applied anywhere outside of Australia but in view of the reported success obtained with this method it is believed that the process is worthy of consideration by American and Canadian railway engineers. Following is an abstract of Colonel Cope's report taken from the Railway Gazette of London for July 31, 1925.

With the object of obviating the re-boring of the tie and preventing its failure by "spike-killing," H. A. Cresswell, chief engineer, ways and works, Western Australian Government Railways, determined to provide some composition which should possess sufficient holding power against the pull and thrust of the spike when subjected to stresses due to heavy rolling loads of trains, and with which the original enlarged spike hole could be filled and into which the cut or screw spike be driven. It was realized as essential that such a composition must be inexpensive and easily and conveniently applied to the spike hole of the tie in place.

After a number of experiments a satisfactory bituminous composition has been manufactured, and the application has proved so successful that on the Western Australian Government Railways, with 3,629 miles of main line, thousands of tie renewals are being saved annually; or, rather, the ties which would otherwise be removed from the track have been treated and their life prolonged by several years. The composition is sent out to the maintenance gangs in cake form. The cakes are broken up and the composition is re-heated to the boiling point in a suitable portable cooker. The old spike holes are thoroughly cleaned out and the hot composition poured in and rammed lightly. After allowing about three minutes for it to cool, but while still in a plastic condition, the spike is driven into it, the composition becoming quite hard and set in about 15 min., thus tightly gripping the spike and permitting ordinary traffic to be maintained without interference.

The tests conducted have been made with the following composition:

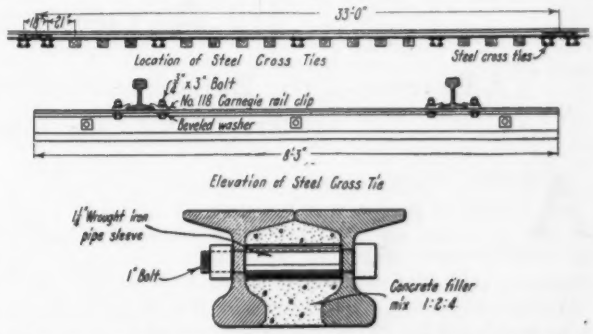
1 quart tar.
4 oz. pitch.
1 lb. bitumen.
2/5 pint of kerosene.
2 lb. hardwood sawdust screened to remove dust.

Laboratory tests show that the pull required to withdraw ⅝-in. spikes out of the reconditioned holes amounts to about 4,000 lb. This represents a good resisting power in hardwood timbers, but it is interesting to note that, although when the spike is driven into the wood itself the holding power, under the influence of traffic and other causes, is soon reduced, very little diminution is noticeable when the composition is used, and the spike holds as well after subjections to severe stresses as when first driven into it, and can be pulled out and re-driven and still be found holding firmly. Although in the early stages the composition used did not give as satisfactory results as could be wished, later experiments with an improved process of manufacture have been very satisfactory, and the principle has now been adopted generally throughout the system.

A New Substitute Tie

FOR MORE THAN a year the Terminal Railroad Association of St. Louis has been conducting service tests with a composite cross tie, consisting of two pieces of 100 pound scrap rail enclosing a core of concrete. The design of the tie is exceedingly simple, as seen in the illustration. It is made by cutting a 33-ft. rail into four pieces, thus making the tie 8 feet 3 inches long. The width of the bases of the two rails gives the tie a top width of 10½ inches. All work in the preparation of the material and the fabrication of the ties is done by track labor in the material yard, except for the making of the bolts.

For the purpose of testing these ties a number of them were inserted in a track in the terminal where the average daily traffic movement consists of 39 trains, 876 cars, or 28,530 tons. To minimize the cost of this initial installation the ties were placed five to the 33-ft. rail,



Elevation and Section of the New Steel Tie and Location Diagram

as shown in the diagram, as this obviated the removal of a large number of wooden ties possessing considerable service life. It is believed that when the remaining wooden ties are replaced by steel ties it will not be necessary to use more than 14 or 15 of the steel ties to the panel, as compared with 19 or 20 wooden ties, because of the wider bearing afforded by the steel ties and the fact that the flange projects out over the base. It has been found that the flanges confine the ballast and reduce the tamping required to maintain proper surface.

The ties used in the test were equipped with the clips and bolts used with the Carnegie steel ties, but experience in this test has shown that these fastenings are not strong enough. In view of this a new fastening has been designed in which the clip on either side of the rail engages both bolts passing through the flanges of the tie, an arrangement which definitely prevents the clip from turning.

This tie has been developed and tested under the direction of Henry Miller, president of the Terminal Railroad Association of St. Louis, to whom we are indebted for the information presented above. In his opinion the fact that these ties are made from scrap rail, that the cost of manufacture is small, that no tie plates are needed and the further fact that these ties will have an appreciable scrap value when conditions require their removal from track, point to definite economic advantages of this construction.

One of England's High Speed Non-Stop Passenger Trains

Are Rail Failures Confined to American Roads?

A Resume of the Experiences of Foreign Railways Shows That They Are Less Numerous in Other Countries

AMONG THE subjects considered at the International Railway Congress at London in June was one on the breaking of rails, reports on which were presented by "reporters" from (1) America, (2) the British Empire, (3) France, and (4) other countries. The report on American practice was presented by W. C. Cushing, engineer of standards, Pennsylvania System, Philadelphia, Pa., and that on British practice by C. J. Brown, chief engineer, London & North Eastern Railway, London. Those portions of their papers which bring out information of particular interest to American maintenance of way men are abstracted below.

American Service Requires Better Rails

By W. C. Cushing
Engineer of Standards, Pennsylvania, Philadelphia, Pa.

As a general rule in North America, rails are not allowed to remain in the track until they are worn so much that they are unsafe. They are needed in other tracks of different and lesser service, and the important tracks carrying heavy traffic at high speed obtain the advantage of new rail. They are thus kept in a higher degree of condition.

The rules for allowable abrasion before removal are not uniform, as the conditions of service are quite different in the many territories of operation. Generally, however, on curves 20 to 28 per cent of the head area is worn away before replacement, although on curves of 3 deg. or less, replacement will be made probably for other reasons before that amount has been lost. On tangents the practice is more variable, because in some cases rail is replaced long before worn out on account of being required in good condition for branch line service. This may be as little as 1/8 in. for 85- or 90-lb. rail, and as much as 5/8 in. for 100-lb. and 3/4 in. for 130-lb. rail.

In order to bring about greater resistance to wear, railroads have made trials of alloy steel which require heat treatment to develop the full value of their effect, and heat treatment of carbon steel without alloy.

Manganese when raised to the amount of 10 to 14 per cent has won an important place in rail steel on account of the great toughness and resistance to abrasion of the resulting steel on sharp curves, but on account of its high cost ($155 per ton) it is only economical for those curves of short radius where the traffic is heavy and grinds away the carbon steel in a brief period. It is not economical for tangent track or track with long radius curves. It has certain shortcomings which have not yet been overcome and prevent its general use in rail steel as follows: (1) The elastic limit is low, 30,000 to 35,000 lb. per sq. in., and a number of breakages has been recorded; (2) It is strong and tough, but the hardness is not superior to that of Bessemer steel, and consequently the resistance to batter at the ends of the rails is not altogether satisfactory.

No manganese rail of heavier section than 100 lb. per yard had been rolled up to the end of 1923, but during the current year the Illinois Steel Company has rolled manganese rail of the 130-lb. P. S. section for the Pennsylvania System.

Such systematic and recorded trials of track laid with rail inclined in comparison with track laid with the rail axis at right angles to the ties as have been made in this country have not indicated any effect upon increasing or decreasing rail breakages, or, for that matter, rail failures. Very few such trials have been made. Several roads express their opinions, some of which are based upon observations of their own track laid both ways.

The Lehigh Valley, the Wabash, the Chesapeake &

Ohio, the Illinois Central, and the Chicago & North Western believe that breakages are reduced by inclined rail. The inclination is usually 1 in 20 though in other cases 1 in 40, and 1 in 44 have been used. The standard wheel-tread taper of the American Railway Association is 1 in 20, but the New York Central Lines have adopted a rail cant of 1 in 38, and the Baltimore & Ohio from entirely different reasoning 1 in 13.

The Union Pacific from theoretical reasoning thinks that rail breakages should be reduced by inclined rail on account of less eccentric bearing, while the New York, New Haven & Hartford does not think breakages are increased by rail laid vertically. The Chicago, Milwaukee & St. Paul has not observed that there are more breakages laid vertically, but thinks that rails inclined 1 in 20 do not wear as rapidly from the tread or flange, and are easier to hold in line and gage. Some of the engineers of the Pennsylvania believe that split head failures are reduced to some extent by inclination. Rail canting is being practiced by quite a number of companies in North America, either as a fixed standard, or partially for certain kinds of track, but it is never carried through the frogs and switches of tournouts.

It is the general observation that there are more breakages on a descending than on a rising gradient on account of the high speed of trains, especially near the lower end of the slope, as the high speed brings into greater action the forces due to excess counterweights on drivers, and badly worn wheel treads. Three roads, however, the Wabash, the Illinois Central and the Chesapeake & Ohio, are inclined to think that breakages are more numerous on the rising gradient.

Heavier Rail Being Used

An important step in the effort for improvement of rail service was the jump from the use of a 100-lb. rail to the heavier weights, 130, 135 and 136 lb. per yard. The first of these heavy sections was the 135-lb. rail of the Central Railroad of New Jersey which was rolled in 1910 for use on very sharp curves (10 deg. to 14 deg.), where the traffic was heavy. About 40 miles are in use, but no more will be ordered, as it is the intention of the company to lay 130-lb. R. E. instead.

The 125-lb. P. S. section of the Pennsylvania was first rolled in 1915, but was changed to the 130-lb. P. S. section in 1916 by the addition of ⅛ in. on the top of the head. It has been pretty well determined from the study of our records that the rail failures in 100-lb. rail are from 2 to 2½ times as many as in 130-lb. rail. By comparing the different kinds of rail which have been laid consecutively on the same sharp curves and keeping a record of the length of service we estimate that the life of 130-lb. rail may be from 20 to 30 per cent greater than that of 100-lb. rail in the same location. No precise records of the relative cost of maintenance have been kept, but there is a general opinion among the trackmen that there is economy in the labor maintenance of 130-lb. rail over 100-lb. of from 20 to 30 per cent, which is not always taken advantage of by a reduction in forces, but in the maintenance of a better condition of track. It is well settled in our minds that the business of this company could no longer be carried on adequately on the 100-lb. rail section, where our traffic and rolling stock are the heaviest.

The Lehigh Valley began laying the 136-lb. L. V. section in 1916 and reports that it has records giving more than twice the life on curves under increased traffic that was obtained from the 100-lb. R. A-A section previously in use, and there are 10-deg. curves laid with the 136-lb. rail where no work was required in four years to readjust the line and surface.

Rail Steel Must Be Improved

In spite of this large increase in rail weight, rail failures continued to occur, but with diminished frequency, and the type of failure indicates that improvement in the quality and strength of the metal is required rather than a further increase in the weight per yard. From the study of the rail design, we find now that our effort must be concentrated upon the study of the material in order to improve it in such a fashion that it will be suitable for absorbing its peculiar stresses and transmitting the super-imposed weights to the roadbed with perfect safety. We are on the eve of another period of research, and this time into the material of construction which goes to make up the rail.

The use of various alloys has been considered, high manganese, nickel and chromium, but without heat treatment the alloys are not used to their best advantage. Nickel and chromium in rail steel have been tried by several railroads without heat treatment, but the result was indifferent, the failures in some cases being greater than for carbon steel, perhaps because the right proportions may not have been introduced. The amount of nickel alone which has been used was 3.25 to 5 per cent. The amounts of chromium and nickel together have been 2 to 2½ per cent nickel with 0.50 to 0.90 chromium in some instances, and in others somewhat less. As chromium is a hardener, and nickel a toughener of metal, the combination ought to be good, but in all probability they require heat treatment to bring out the good effects, as is the case with motor car steel.

Manganese steel is valued mostly for its resistance to abrasion, and has been considered already in connection with rail wear. Rails finished in the electric furnace have been tried by some railways, but without marked advantage.

Whenever a high class steel is required for a special purpose, it is made generally from ingots which were teemed with the assistance of a sink-head, with the large end of the ingot up, as it keeps the upper end hot, conducing to more uniform cooling which lessens segregation and makes sounder and denser steel. Trials of rail steel prepared in this way in 1914 and 1915 have been made with good results. There were only 171.5 head failures per 100 miles of track of sink-head rail as compared with 415.4 of ordinary open-hearth rails, but the most satisfactory part of the record is that there were only 63 broken sink-head rails per 100 miles of track against 200.6 broken ordinary open-hearth rails per 100 miles of track, showing that the sink-head not only helps to lessen head failures, but has such an effect throughout the entire ingot as to reduce the breakage as well.

It should be advantageous to use the oxidizers titanium, vanadium, silicon and aluminum, which act as scavengers to make steel more homogeneous, in conjunction with the sink-head, for the latter would help to nullify the tendency of the former to form a deeper pipe.

The production of the Sandberg Sorbitic microstructure by hardening and toughening the upper part of the head, which must undergo the greatest severity of service, by cooling it more rapidly than normal by means of an air blast controlled and directed so as to bring about the cooling in the desired portion of the

head, is being tried in service by several companies, and, while in general it is reported that the abrasion of the head is somewhat less than in the case of open-hearth rail, it is not considered that they have been in service sufficiently long to make definite pronouncement.

This seems to be a sort of partial heat treatment which does not appear to the reporter to bring about sufficient improvement in the metal to meet the demands of the service required by the conditions of the period which is now at hand. There is the utmost necessity for great and radical steps forward.

Twenty-five years of work upon the improvement of the specifications have not brought the result required. Many changes have been introduced which have been beneficial, but the great improvement, which is increased strength and ductility to the extent necessary, has not been reached.

To attain this, study brings us to heat-treated steel. Trials of heat-treated 100-lb. and 125-lb. rails, prepared at the Altoona shops of the Pennsylvania, and by two or three of the manufacturers, have been made in the tracks of that system with encouraging results. In the service trials there is a decided improvement in the resistance to abrasion from wheels, amounting to from 12 to 64 per cent less wear. In the lots carefully prepared, there was only one broken rail.

The Problem Is Not as Acute in Great Britain

By C. J. Brown
Chief Engineer, London & North Eastern Railway, London

On British railways the maximum axle load generally adopted is about 20 tons, although in one case an axle load of 25 tons, evidently a special vehicle, is reported, while the maximum speeds on the larger roads are stated to be from 60 up to 80 miles per hour. The section of rail adopted for fast and heavy traffic on British lines ranges in weight usually from 90 to 100 lb. per lineal yard, and for the lighter traffic lines from 75 to 85 lb. per lineal yard. Most of the companies now adopt the British Standard sections of rail, the most common being the 95-lb. for heavy, and the 85-lb. for light traffic. There are, however, considerable mileages of older, and in some cases less satisfactory, sections in use on many of the railways, which must still tend to contribute an undue proportion to the number of rails annually found broken in the track.

The average number of rail breakages each year, taking the five years 1919 to 1923, on the larger British railways or sections of railways, is relatively small, ranging from 1 in every 127 miles to 1 in every 450 miles of running track. The classification of breakages emphasizes the well recognized fact that the joint is the weakest part of the track, in several cases the percentage of the total number of breakages reported at the joint or within such a distance as leaves the rail still under the influence of the weak joint, is as much as 70.

The standard average spacing between centers of ties on British railways is now 2 ft. 6 in., but the ties adjacent to the joints are rather closer together than this, and those in the center of the rail rather wider apart, the actual spacing between centers of the ties immediately on each side of the joint being about 2 ft.

Almost all of the roads favor the present type of suspended joint, although one or two advocate a suitable type of supported joint as tending to eliminate the breakages at or near the end of the rail.

The general view is that segregation and piping can only be guarded against by sufficient cropping of the ingot and rail. Several replies agree that local defects causing breakage may be due to a lack of protection of the rails during cooling, and indicate the importance of suitable means being provided for covering over the cooling banks. So far no breakage appears to have been attributable to the development of transverse fissures in the interior of the metal.

Many of the companies are using or experimenting with special steels, such as manganese, chromium, high silicon and sorbitic, with the object of increasing the amount of wear to be obtained from the rails, although generally their use is neither so extended, nor the time during which they have been tested so prolonged as to have any effect on the number of breakages.

On the South African railways it is reported that while the use of high silicon rails resulted in increased resistance to wear, the relative number of fractures with this steel as compared with ordinary steel has increased.

Longer Rails Are Used

As the rail joints are an admitted source of weakness, anything which will tend to reduce their number warrants most careful consideration, and the question of the maximum length of rail which can be adopted without sacrifice of efficiency becomes, therefore, a matter of prime importance. The general standard length of rails on British lines is now 45 ft., but on the London & North Western section of the London, Midland & Scottish railway 60-ft. rails have been the standard for many years, and there is a growing inclination to follow this lead, thereby effecting the very marked reduction of 25 per cent in the number of joints in the track. The additional price hitherto asked by manufacturers for the greater length has acted as a deterrent, but it is to be hoped that this differential charge will eventually disappear.

The general practice on these railways is to keep the joints of the two rails opposite to one another and not alternating. The ties on each side of the joint are also almost invariably placed symmetrically to the joint.

Creeping does not concern British railways to any great extent, but the general opinion is that this should be dealt with by means altogether apart from the joint which should not be expected to act as an anti-creeping device.

Several companies have laid short experimental lengths of rails with the ends cut obliquely to the longitudinal axis of the rail with the object of reducing the shock at the joint, and one of these companies considers the arrangement satisfactory and tending to reduce creeping, although another has found that after a time any advantage which the device may have had at first has disappeared. The general adoption of such an arrangement would seem to present considerable difficulties and involve additional expense, and is hardly to be recommended.

Various devices are used in most cases to prolong the life of the fishplates as much as possible. One is the use of thin metal strips to take up wear between the fishing surfaces, although this is regarded by most of the companies using them merely as a makeshift. In one or two cases somewhat deeper plates are provided for maintenance work which effect the same purpose of taking up wear. The plates may also be

changed end for end or reversed periodically to equalize the wear. On British railways it is not the practice to recondition plates, but reconditioning is done on the Malay States and South African railways. Metal strips of tapering thickness with the greatest thickness at the center are also used on the former railway.

In order to assist the rails in expanding under increasing temperature it is the usual, although not universal, practice before the hot weather sets in to slacken back the bolts of each joint and coat the fishplates with oil or a mixture of tar, tallow and lime, which has a lubricating effect on the fishing surfaces, before screwing the bolts up again. In some cases this treatment is given twice a year. The practice possesses obvious advantages in that it insures that each joint can be carefully examined at least once a year, thereby enabling the presence of cracks which may be developing at the rail end to be observed, while at the same time provision is made against possible buckling of the track in the ensuing hot weather.

The life of the tie plates and bolts, where given, is estimated at varying figures, but where not stated to be the same as the rail, is generally given at 15 or 20 years. Little or no reconditioning is done.

Bureau of Safety Holds Track Forces Responsible for Accidents

AMONG a number of recent reports issued by the Bureau of Safety of the Interstate Commerce Commission following the investigation of train accidents, are several covering derailments in which the conditions disclosed pointed to the conclusion that the section foreman or his superiors were primarily responsible for the accidents. Because of the lesson which is to be found in the circumstances surrounding these cases, we present summaries of four of these reports below:

Inadequate Spiking Causes Serious Accident

According to the report of the Bureau of Safety of the Interstate Commerce Commission the derailment of a freight train on the Chesapeake & Ohio, which resulted in the death of one trainman and 11 track laborers was caused by the drawing of the spikes preparatory to the renewal of rails. The accident occurred on a 7-deg. 30-min. curve laid with 33-ft. 90-lb. rails, with 17 to 18 ties to a panel in 18 in. of gravel ballast. The ties were single spiked and equipped with tieplates This rail was being replaced with 100-lb. rail and the rail renewal operation being carried from west to east, had been completed to a point only a short distance from the west end of this curve at the time of the accident. The train derailed was a westbound freight train, the derailment occurring on the portion of the track laid with 90-lb. rail some distance east of the point where the temporary joint had been made between the 100-lb. and 90-lb. rails. At the time of the accident the extra gang was lined up along the track waiting for the freight train to pass and the majority of the laborers killed were caught between the derailed cars and the abutment of an overhead railroad bridge of the Pennsylvania which crosses the Chesapeake & Ohio at the west end of the curve.

Measurements taken of the track east of the point of derailment showed that the gage was wide from ⅛ in. to 11/16 in. over a distance of 380 ft. The elevation, within this distance varied from 3⅞ in. to 4⅝ in. The spikes had been drawn from every other tie preparatory to renewing the rail.

The conclusion of the Bureau of Safety is that the accident was caused by spread rails and the following quotation from the report presents the reason for this condition. "The track was materially weakened by the fact that the spikes had been pulled from every other tie nearly the entire length of the curve, this weakened condition being accentuated by the fact that nearly 17 per cent of the ties were split and broken or decayed, resulting in their holding qualities being materially reduced. * * * On a curve as sharp as the one on which this accident occurred it is of vital importance that the track be in good condition in order to withstand the strain laid upon it, and it seems apparent that the weakened condition of the track, coupled with such irregularities in gage and alinement as existed, resulted in spreading the rail sufficiently to allow a wheel or wheels to become derailed."

Insufficient Superelevation Causes Derailment

A passenger train on the International & Great Northern was derailed near Longview Junction, Texas, on a two-degree curve, resulting in the death of one passenger and the fireman and engineman, and the injury of 25 passengers and one employee. Investigation by the Bureau of Safety of the Interstate Commerce Commission brought about conflicting statements as to the speed of the train which was estimated by various persons at from 35 to 65 miles an hour. An examination of the track showed that the gage was generally well maintained but the superelevation was decidedly irregular, varying from 1⅜ in. to 4½ in., and changing as much as 1-in. in half a rail length. The superelevation was 1½ in. at the point where markings on the rail indicated that the first wheel became derailed. Testimony by maintenance of way officers showed that it was the intention to maintain this curve at an elevation of 2⅝ in., but that in their opinion two inches would have been safe without restricting speeds.

Inquiries were made of the officers of six other railways operating in Texas as to what elevations were considered necessary for a two-degree curve, and four of them replied that they followed the recommended practice of the American Railway Engineering Association which calls for a superelevation of 4¾ in. for a speed of 60 miles an hour. However, the majority of them expressed the opinion that 2¼ in. would be safe for track maintained in good condition.

The conclusion of the Bureau of Safety is that the accident was due to failure to maintain the surface of this curve in proper condition, coupled with an elevation inadequate for the operation of trains at unrestricted speed.

Failure of Foreman to Throw Switch Causes Fatal Derailment

An investigation by the Bureau of Safety of the Interstate Commerce Commission on the derailment of a passenger train on the Quincy, Omaha & Kansas City near Kirksville, Mo., resulted in placing the responsibility for the accident on the section foreman. The train in question was an eastbound passenger train which

was derailed at a facing point switch, an examination of which after the accident showed marks which indicated that it had been previously run through by a westbound train. The switchpoint was slightly damaged and was about half open.

Further investigation showed that the reason for the switch being run through was that the section foreman had opened the switch to run his motor car out of the siding after the passing of the train and that he had failed to close it before proceeding with his car. Although evidence showed that the target of the switchstand showed red and the accident could have been prevented if the engineman had observed the target and applied the brakes within the distance that the target was readily visible, the report of the Bureau of Safety holds the section foreman primarily responsible for the accident.

Insecure Track is Cause of Derailment

An eastbound passenger train on the Chesapeake & Ohio, known as No. 2, consisting of seven steel coaches and sleeping cars, was derailed near Quincy, Ky., approximately 105 miles east of Cincinnati, at 2:48 p. m. on April 29, 1925, resulting in the death of 1 employee and the injury of 29 passengers, 5 employees and 5 other persons. The track at the point of accident was level and on tangent, on a fill varying in height from 4 to 10 ft. and was laid with 100-lb. 33-ft. rails, with 18 to 20 ties to the rail length and ballasted with stone.

At the time of the accident a force of approximately 35 men was making extensive track repairs, the track having been raised from 4¼ to 4⅝ in., for a distance of 514 ft. west of the point of derailment. A number of old ties had been removed and new ties installed, although the rails had not been spiked to many of the newly installed ties, there being seven ties which were not spiked in the panel in which the first indication of derailment was found. There was only 2 or 3 in. of ballast between the ties; the ballast appeared to have been packed beneath them, but was not firmly packed at the ends of the ties.

The train was running at a speed of 45 to 50 miles per hour at the time of the derailment. The entire train was derailed, although the four rear cars remained upright. A portion of the track was carried down the embankment and lay beneath the overturned locomotive.

In the investigation conducted by the Bureau of Safety of the Interstate Commerce Commission, the track supervisor stated that he had marked the ties to be renewed, three months previously, finding as many as 13 in some panels, but averaging approximately 6 per panel. In renewing these ties he had instructed the section foreman to raise the track from 2 to 3 in. and to keep it well filled behind him.

During the forenoon of the day of the accident the section foreman stated that he had raised the track and made the necessary tie renewals for a distance of about 14 rail lengths and had then made the track safe for the passage of two passenger trains. In the afternoon he had raised the track for a distance of about nine rail lengths, and when the train which was derailed approached he was completing the work on this section to place it in condition to leave for the night. The stone ballast had been cleaned by forking it over. A run-off from the raised track of approximately three rail lengths had been provided which had not been fully completed.

The Division of Safety of the Interstate Commerce Commission concluded that the accident was caused by insecure track, insufficiently ballasted and with ties insufficiently spiked; for the unsafe condition of the the track at the point where the accident occurred the track foreman was responsible. The conclusions were in part as follows:

"After the accident a portion of the track which had been undergoing repairs was badly kinked and part of it had been carried over the embankment with the derailed locomotive. It is clearly apparent that the track which was undergoing repairs had not been sufficiently ballasted and ties had not been sufficiently spiked to render it safe for the passage of train No. 2 at its normal rate of speed. The ballast should have been filled in between the ties and packed securely beneath the ties and all ties should have been properly spiked before train No. 2 was permitted to use the track at full speed, or this passenger train should have been required to pass over this track at reduced speed."

Train Goes Through Burned Bridge

A recent report issued by the Bureau of Safety of the Interstate Commerce Commission presents an account of the accident occurring on the Musselshell division of the Chicago, Milwaukee & St. Paul, in which the locomotive of a passenger train fell into the gap formed by the burning out of two panels of a pile trestle known as Bridge 88.

The bridge consisted of five bents, composed of cedar piles with 14-in. by 14-in. caps spanned by two stringer cords of three pieces of 10-in. by 18-in. Douglas fir each. The ties were covered with 20-gage galvanized iron as a protection against fire. This sheathing had been renewed in November, 1924, and was in good condition. The train was traveling at the rate of about 25 miles per hour at the time of the accident; the bridge is on a tangent so that the view is clear, and apparently there was no sign of fire discernible from the engine, although there is no evidence as to this because both the engineman and fireman were killed.

Investigation failed to develop any facts that would show how the fire started. The last preceding train over this bridge crossed it over 11 hours before the accident occurred and, as it was raining at that time, there seemed little likelihood that the fire was caused by the preceding train, or from the burning of a pile of old ties near the bridge or from several loads of cinders which were hauled across the bridge the previous day.

During the course of the investigation the roadmaster reported that section foremen were required to inspect their sections once every 24-hour period, ordinarily the first thing in the morning, but that the railway maintained no other track patrol except under unusual conditions. As the accident occurred at 10.12 a. m., the obvious question was why the section foreman had not discovered the condition of the bridge. In the examination he stated that while he usually made a trip over the section the first thing in the morning he had not done so on this particular day because of other plans for his work and because he knew that the crew of the adjoining section had passed over his entire section the previous evening.

It was shown that the book of rules of the railroad for maintenance of way employees did not require a section foreman to patrol his track daily and no bulletins or letters of instructions had been issued to this effect. The Bureau of Safety states that "A portion of responsibility for this accident must, therefore, rest with the railroad company for failure to maintain adequate track inspection."

A Flash-Light Picture of the Annual Dinner on Wednesday Evening.

Bridge and Building Association Meets at Buffalo

Active Discussion of Practical Problems Characterizes Thirty-fifth Annual Convention

NO RECENT convention of the American Railway Bridge and Building Association has witnessed more active discussion of the committee reports and papers than that held in the Statler hotel, Buffalo, on October 20-22. Although a smaller number of reports was presented than in past years, the discussion was so active that the convention was constantly pressed for time.

Approximately 200 members of the association were in attendance. Those from points west of Chicago and Detroit traveled to the convention on a special train provided by the Michigan Central which left Chicago at 9:00 o'clock on Sunday evening and stopped at Niagara Falls for several hours on Monday to permit members to examine the bridge which the Michigan Central completed across the Niagara gorge early this year.

The sessions were presided over by J. P. Wood, president of the association and supervisor of bridges of the Pere Marquette at Saginaw, Mich., with C. A. Lichty, inspector in the purchasing department of the Chicago North Western at Chicago, as secretary. The convention was called to order promptly at 10 o'clock on Tuesday morning by Mr. Wood, who introduced F. M. Barker, vice-president of the Buffalo Chamber of Commerce and division superintendent of the Lehigh Valley at Buffalo, who welcomed the convention to that city. In his address, Mr. Barker pointed out that Buffalo is a transportation city, located at the end of the Great Lakes natural waterway and thereby the point of trans-shipmen from lake to rail and vice versa. He spoke in part as follows:

"The railroad business is the largest single industry in Buffalo, employing about 22,000 men. Buffalo is the second largest railroad terminal in the world, with some 14 railroads serving 3,200 industries. In this Buffalo-Niagara Frontier territory there are some 1,500 miles of railroad trackage.

"You men of the bridge and building department have kept your standard of maintenance high, at as low a cost as possible. While engines and cars have increased in size, requiring heavier bridges and buildings, you have met this situation by strengthening your bridges and your buildings, without any very great increase in cost—and you have done it in spite of the fact that in the past eight or ten years labor costs have increased practically 100 per cent and material costs over 50 per cent. This has been done, in my judgment, very largely by you men getting together for the general exchange of ideas, discussions, etc., in such organizations as the American Railway Bridge and Building Association."

In an address presented at the opening session, President Wood reviewed the history of the Bridge and Building association briefly and then emphasized the necessity for the association collectively and the members individually, keeping in touch with current developments. He stated that "changing conditions have compelled us to change our methods and what seemed good practice only a few years ago is now obsolete. The scarcity of some materials in some sections of the country and the advent of other materials to take their place has taught us to economize as well as change our designs. The rapid increase of our population has caused a like increase in production to supply its need, and this demand has been met by our railroads with the purchase of heavier rolling stock. Have you and I kept pace with all the progress of the last few years? Let us take stock of ourselves and answer this question, for to the fleet of foot is the race."

The report of Secretary-Treasurer C. A. Lichty showed an excess of receipts over expenditures of $107 and the addition of 35 new members during the year.

A special feature of the program was an illustrated talk on Tuesday evening by George J. Ray, chief engineer of the Delaware, Lackawanna & Western, on the stand-

ards of bridge and building construction on that road, in which concrete has played a prominent part. Mr. Ray showed illustrations of many structures and described the features underlying their design.

On Wednesday morning H. Ibsen, special bridge engineer of the Michigan Central, presented an illustrated talk on the erection of the Michigan Central bridge across the Niagara gorge at Niagara Falls. This talk was illustrated with numerous slides showing various steps in the erection of this unusual structure.

The annual dinner of the Bridge and Building Association and the Bridge and Building Supplymen's Association was held on Wednesday evening with approximately 290 members and members of their families present.

Report on the Handling of Minor Maintenance Jobs

THE SIZE OF jobs to be classed as minor will be those which can be done with four or less men. Minor jobs can be divided into two general classes: viz. (1) those which can be deferred until the regular bridge or carpenter crew on its routine trip arrives, and (2) those which are of an emergency nature and require immediate attention.

The well conducted maintenance department conducts periodical inspections from which a schedule or program of procedure of work is made for the guidance of the maintenance force. In spite of all precautions that may be taken, there will be minor jobs to care for out of schedule order, and their proper handling will depend upon whether or not they are of an emergency nature. Some of them may be deferred until a man can be sent from headquarters or a nearby gang. To determine the urgency, proper information from the source of the report must be obtained. Too frequently wrong or insufficient information is given. Co-operation of the bridge and building forces with agents, operators, section foremen, trainmen and others likely to report defects is essential. They should be urged to give accurate data and state the seriousness of defects.

Emergency minor jobs, such as broken window-glass, plumbing defects, failures in heating plants or water and coaling stations, broken locks and doors, broken planks in floors, platforms or sidewalks, are a source of annoyance and need prompt attention. The nature of the territory will determine largely the method employed to care for them which, in fact, may also apply to the handling of non-emergency minor jobs. Where the territory is fairly concentrated and train service frequent, special men aside from regular crews, forming a sort of flying squadron, might be used. The men should be trained to keep in touch with headquarters constantly so that they can be reached quickly.

However, where the territory is widely scattered and train service infrequent, it may be expensive to send out men from gangs or headquarters. Regular crews on routine work should be as free from interruption as possible, for taking a man away may disrupt the gang. Then, too, traveling time is unproductive and a long ride to and from a job runs up its cost.

The question then may well be asked: "Why not arrange with local contractors to care for these small jobs?" It is not uncommon for railroads to contract for work, although this practice is chiefly confined to large jobs. However, contractors ordinarily do not want to do small jobs on a lump sum or unit basis. There is, also, the trouble of making contracts and payments. Some contend that contractors will charge exorbitant prices or do unsatisfactory work. It is true that caution must be exercised and care taken to see that undue advantage is not taken. If officers are on the alert they will soon detect such abuses. Competitive bids might be taken, but this would be tedious for small jobs, such as repairing a lock. But all contractors are not dishonest.

Answers to a questionnaire representing 28 railroads, showed that 13 make a regular practice of arranging with local contractors to care for minor jobs; 8 do it occasionally and 7 do not do it at all.

Some Suggestions

The possibility of having a list of local parties on whom the agent can call to do odd jobs should receive serious thought and be utilized whenever possible and when not in conflict with labor board rulings. Standardization of parts such as locks, size of window panes, doors, types of valves, plumbing, and, in fact, construction in general will tend toward economy in making repairs. With uniform standards there will be less repair parts to carry on hand. Then, too, when defects are reported there will not be so much doubt as to the quantity and kind of material to take. A flying squadron or an inspection repairman will also be able to carry a supply of small parts which will care for most emergency jobs. To avoid the commercial objection often raised to standardization, districts, rather than an entire system might be the units of standardization.

Consideration should be given to use of materials for making repairs, such as plastic cements and paints for patching or covering metal roofs and gutters, cold patch material for repairing platforms and filling of cracks in cement walks with asphalt, tar or pitch. Serious thought should be given to time and labor saving devices. Men frequently devise some scheme for saving labor and such actions should be encouraged. Motor cars and auto trucks will in many instances expedite the getting of men and material to and from jobs. The auto truck will be valuable and enable quick movements, especially in large terminals. Proper equipment and tools are essential for economical handling of work. Men should be required to equip themselves with proper tools and be equipped with those they cannot reasonably be expected to supply.

Wisdom must be exercised in choosing men who are detailed to care for minor jobs. They should be ingenious and dependable.

Co-operation with forces of other departments will be of valuable assistance. Some bridge men object to section men shimming under rails on bridges when the track heaves. This is a questionable objection. Section men can easily make a poor condition safe in this way. Any such temporary repairs should be reported to bridge crews so they can be checked up and corrected if need be and explanation made, if wrong.

Work of other departments should be noticed to see that it does not create conditions which will result in frequent minor repairs. Their use of facilities should be watched. Shop and roundhouse employees will frequently permit water to run on to floors, throw waste and refuse into drains, turn live steam into wrong places in sewers and drains, resulting in its backing into downspouts, causing them to rust, etc. Penstock locks are frequently knocked off by train-

men because a key is not handy. Penstocks are frequently pulled down because the engine is moved before the penstock is swung clear. Coal chute aprons are knocked off because engines are started too soon. The improper surfacing of track by section men frequently requires a bridge to be raised. The care of steam, water and heating plants should be watched and those handling them properly instructed as to their care. Low water in heating plants is frequently the cause of a hurry-up call, also the careless handling of machinery at coal chutes, water stations and draw bridges.

Consideration should be given to permitting men sent out to make emergency repairs to purchase small articles locally, possibly arranging for the agent to pay for them. Usually local dealers will charge the account to the railroad and send in a bill to the proper officer.

Periodic reports of work done should be made to the supervisory office. These should be studied to see that the correct method was used. The idea of getting a job done and forgetting about it, is wrong. The performance should be scrutinized for possible improvement in future procedure and some offices when sending men out to do a job indicate what they consider a reasonable time to complete it. The determination of the proper method to use in handling any work is based upon the cost and value of the result. Such costs must be subject to comparison.

The many varying conditions under which maintenance work is done makes it difficult to obtain comparable costs, and it, therefore, was not considered practical to attempt to gather cost data. No general rule for economical handling of minor maintenance jobs can be evolved unless it be that the supervisory forces must exercise good judgment based upon past experience and be on the alert at all times, keeping in mind the necessity of efficiency and economy, harmonious co-operation with other departments and possession of the good will of their subordinates.

J. P. Wood
President

Extracts of Reports From Various Roads

Erie: This subject has been given a great deal of thought on the Erie and we have a system which is quite elaborate to take care of the situation. For many years we have had an annual program of repairs for bridges and buildings, based on an annual inspection made in the month of August by the division engineer and master carpenter of each division.

We have started the system of having the small jobs done by local contractors. Although their labor rates and prices for material are high, they usually total to less than the amount we can do it for ourselves.

At one time we authorized agents to pay for the work, but this has been changed and the regional treasurer now handles it, as it is found to work out better and does not make as many complications in the agents' accounts. We also have cases where the agent buys a small amount of material and makes the repairs himself, which is handled along the same lines. These emergency repair orders are limited to $100, and are given careful check to see that they are not abused.

Illinois Central: The plan used to some extent on building jobs, where the cost is not in excess of $25, is for the station agent to call on local mechanics or contractors for bids on the work required which are submitted to the superintendent for authorization. In urgent cases the agent is permitted to accept the lowest bid without the authority from the superintendent, provided the cost will not exceed $5.

The local contractor or mechanic is usually paid promptly by the agent from his station funds, which is later adjusted by a voucher issued by the superintendent. We find this plan results in more prompt repairs at less expense to the railroad and also has a tendency to create a better feeling toward the company in some of the towns along the line.

Pennsylvania: Minor repairs pertaining to windows, locks, heating plants, drinking and toilet facilities, lighting systems gutters and downspouts, etc., are quite frequently handled by contract with local contractors in cases of emergency or when the regular forces can not handle promptly. In such cases the division engineer authorizes the agent to have small jobs done locally. The agent forwards the bill to the division engineer for approval. When the job requires the time of a man for more than one day bids are received by the agent from several contractors and are forwarded to the division engineer who awards the work to the lowest bidder by letter. When the work is completed the bill is presented to the agent, who forwards it to the division engineer for handling.

Baltimore & Ohio: On small jobs, such as glazing and repairs to locks, which can be handled by one man, the work is usually taken care of by one man from one of our carpenter gangs who is especially asigned to such jobs. As a general proposition this man is also a district bridge inspector who can handle small repair work of this nature in connection with his regular inspections.

The practice of having local contractors handle repair work is done only for such items of work which require specialists, or in cases where the performance of work by our own forces would involve too great a loss of time in traveling.

Lehigh Valley: The question as to whether work should be done by contract or by company forces depends almost altogether on the matter of economy as between the two methods. Wherever possible the work of building repairs is done by the nearest carpenter gang who may be located in their equipment cars nearest the job. When no available employees are located close enough to the work so that it can be done without loss of time traveling, arrangements are made with a local contractor to do the work.

Pere Marquette: Minor jobs of small contract work are generally not as satisfactory as if done by our own forces. The average carpenter, painter or plumber in the small towns has a different system of doing work than that followed by railroad men. The best carpenters and contractors will not bother with these small jobs, and the result is that when we have such work done it is by an inferior class of mechanics.

Union Pacific System: We have at various times carefully considered contracting small jobs, but our study and ex-

periment has brought us to believe that the complications arising, together with the supervision and inspection required, results in less satisfactory work being done and no savings in money. We therefore do practically all of our repairs with our own men.

Boston & Albany: We have endeavored to establish the system of letting out minor jobs to local contractors, especially at outlying points, but without any particular success. We find that it actually costs more in the end than to have the work done by our own men. We find it difficult to get local men to take the work at a reasonable figure and get it done promptly, and when other things are taken into consideration we find it much more satisfactory to have the work done by our own men.

We occupy an advantageous position in that we have but a short line and the mileage traveled in getting to and from work is not great. We are gradually getting both our bridges and buildings down to a zoning basis so as to further reduce

Boston & Maine: The agent, upon receiving authority from the supervisor of bridges and buildings, hires small jobs of repair work done by some local contractor. Upon completion of the work the agent approves the bill and forwards it to the supervisor whereupon a voucher is made for prompt payment.

Committee: F. W. Hillman, divison engineer, C. & N. W., chairman; R. C. Henderson, master carpenter, B. & O., vice-chairman; A N. Swanson, assistant superintendent bridges and buildings, M. St. P. & S. S. M.; W. J. H. Manning, assistant engineer maintenance of way, D. & H.; R. G. Heck, assistant engineer, C. M. & St. P.; G. C. McCue, supervisor bridges and buildings, C. N. R.; F. M. Griffith, supervisor bridges and buildings, C & O.

Discussion

A. I. Gauthier, (B. & M.) divided small jobs between those of an emergency character and those that are more or less routine in nature, handling those of the first class by either company or contract forces, as most readily available, and the others by company forces. He also sub-divided this work still further, placing the repair of crossing gates, water stations and bridges in one group, which, because of their importance, are invariably handled by company forces. His road has developed a plan for the handling of many small repair jobs with local mechanics. A list of mechanics who are available for work of this character has been compiled in each town and these men are called upon as occasion arises. Experience has shown that this plan saves considerable money. P. N. Nelson, (S. P.) described a system in effect on that road whereby all repair work is done by company employees directed from division headquarters. District carpenters are stationed along the line at intervals of 35 to 70 miles. These men are provided with an outfit car stocked with small quantities of materials and constantly move back and forth over their territories.

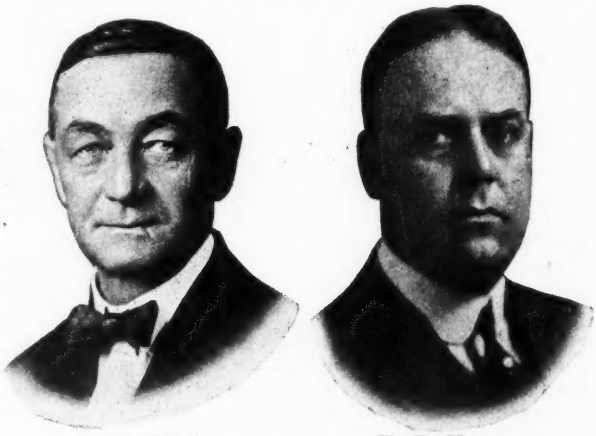
The Future of the Bridge & Building Association

By Frank H. Alfred

President and General Manager, Pere Marquette, Detroit, Mich.

YOURS IS an old organization, composed largely of men who entered the railroad service as artisans of the early days, or were graduated from carpenters and skilled mechanics, to important leadership. From the beginning master carpenters were a very necessary part of the railroad organization. American steam railroad operation as we understand it dates back to August, 1829, when the Stourbridge Lion, imported into this country from England, made its first run on the Delaware & Hudson Company's tramway, two months before Stephenson demonstrated in England the practicability of The Rocket. The Stourbridge Lion was found to be too heavy for the Delaware & Hudson's tramway tracks, making it necessary to discontinue the use of this locomotive. It might be said then that your calling dates from that day. So we may also say that the railroad master carpenter was active in designing and maintaining our railway structures from the outset.

As an organization your association reverts to 1890. The Interstate Commerce Commission of the United States had been created three years before and its first chairman, the Honorable Thomas E. Cooley, the eminent jurist, who was largely responsible for the creation of this body, really gave to the world a new and constructive contribution to an industry which then was playing an important role in the upbuilding of our nation, and is still functioning to the advantage of our country as a whole. Now it seems to me that the birth of the Interstate Commerce Commission was to a certain extent responsible for the creation of the American Railway Bridge and Building Association. The creation of the commission itself marked the raising of the status of the steam railroad transportation industry from a haphazard business to the dignity of a profession, having definite aims and certain defined standards of service. With these definite aims and defined standards came the urgency for specialized study, and so we find the lines of demarcation of the three great groups of employees that are classified under the general term operation become more pronounced, and so we now have these departments—maintenance of way, maintenance of equipment and transportation. Hitherto, it had been the custom that the man in charge generalized and, in reality,



C. W. Wright
First Vice-President

E. T. Howson
Second Vice-President

had charge of and guided these three operations. With this crystallization of opinion on management came the engineer of maintenance of way and with him the inauguration of the bridge and building department. These men long identified with the railroad service effected their organization in 1890. The Maintenance of Way Association (A. R. E. A.), as such, is ten years younger.

To a certain extent your association has revived the ideals and the aims of the trade guilds of earlier days, associations that had as a basis and particular aim the raising of the standard of the craft and, too often, in our modern trend of organization, this point is neglected

or even subordinated to other aims. In this way, the industry itself suffers and, as must necessarily follow, the organization identified with the industry as well.

To the American Railway Bridge and Building Association is due a great part of the credit for the great strides that have been made in the preservation of timber through treatment. Through these processes, the life of timber has been prolonged twice its natural span. To your association is also due in a large measure, the study and tests that have resulted in the substitution of concrete for timber for construction purposes. It might seem at first blush, that you men have practically worked yourselves out of a position—a phenomenon that is only too well appreciated by the members of the engineering profession. Against taking too dark an outlook, it would seem to me that your association will find that with the years will come new problems to solve. These problems will be even more complicated than they are today, for they will involve greater research to effect greater economies than obtain at present. So the association's importance will take on a new standard.

The program for the thirty-fifth convention is an index of the scope of the operations of this department at this time in the studies and in the use of the present units in bridge construction and maintenance; treatment of water; use of electricity for water stations, station lighting; the special studies of designs of modern bridges; the coatings for the protection of steel and iron; the relative merits of metal window sash and other parts of wooden structures—and the greatest of all—the economical methods of handling maintenance of way work.

The department of the railroad has not retrograded with the passing of the old order, rather it has adapted itself to the solution of new problems. If there is any moral that may be drawn from history of any period or any institution or organization, it would seem to me that the glorious achievements of the past of your association, show the course which it will take for the future.

The Man Problem Bridge in Work

By R. E. Wooruff
Division Superintendent, Erie, Buffalo, N. Y.

YOU MEN HAVE a romantic occupation. Everything you do is constructive. You have the joy of building. You older men remember the wooden bridges that were marvelous in their day. These were followed by iron bridges and later by steel. Now you build everything possible of concrete. Buildings also have improved. Water stations are more efficient both from the standpoint of construction and operation. Taking it all in all, our railroads are well maintained because you have learned how to pick the most desirable materials

F. C. Baluss
Third Vice-President

Maro Johnson
Fourth Vice-President

for each use and when you build permanent structures, you save labor.

Labor costs more now than it did years ago and it is your constant endeavor to build permanently to save maintenance charges. Nevertheless, a certain amount of labor is essential. It will never be eliminated. This is a topic which has not been discussed much in your meetings. Perhaps there are good reasons for it. Perhaps you say little about the handling of men and human nature because you feel that it is hard to classify men and learn about them.

You have learned by experience when you can best use red oak, white pine, cedar and you even use tamarack for some purposes. You know when to use concrete and when to use steel and iron. Each material is used where it best serves the purpose. As a matter of fact, men differ from each other also.

Sixty per cent of the money you spend goes for labor and it is part of your jobs as engineers and supervising officers to make that expenditure for labor yield the largest possible returns.

A man spends years learning his trade. He learns all about material, tools, and the tricks of his trade before he becomes a skilled workman and gets a skilled workman's pay. When you need a foreman, you promote a good workman. While he formerly handled material and tools, he now handles men. What does he know of men? As a rule only what he has learned from experience. It is seldom that supervising officers talk to foremen about the handling of men and so they have nothing but their own experience to guide them. Very often a new foreman makes mistakes. Because he is a good workman, his first inclination is to endeavor to get a lot of work done by driving his gang. It is only after bitter experience that he learns that a real foreman must be a leader rather than a driver and that there are better ways of getting work done than to yell at individual members of the gang.

Also, a foreman does not always hire the right kind of men. Railroad work is a little different from ordinary building work. All men are not fitted for the rough, outdoor and irregular hours which you men put in. Some fine building carpenters are not as desirable as the rough and ready carpenters.

Again, even good men do not turn out their best work when they are improperly treated. Men are not machines and cannot be treated as so much material. While men differ from each other, each man has two or three different moods and an enthusiastic, skilled workman will do at least twice as much work as an unskilled "jack-of-all-trades." The quality as well as the quantity of work produced by your gangs depends to a large extent on the way they are treated by the supervising officers.

How should a man be treated? Put yourself in his place. If you were a skilled workman or the foreman

of a gang, what would make you turn out a lot of work of good quality? In the first place, you would like to feel that he respected you—that he was your friend—that he was back of you—that he would help you if you needed help. If you made a mistake, you would like to be corrected in a straightforward fashion. You would feel antagonistic if he told others about your shortcomings rather than yourself. If you did a good piece of work, a bit of commendation would be very welcome. You would dislike to work for a boss who never seemed to know what you are accomplishing and never commended you for good work but who always nagged and irritated you.

Now if you know how you like to be treated, why should we not treat our men in the same way? Commendation when deserved, gets better results than nagging and driving. Railroad men as a whole are hearty, healthy, outdoor men. They are independent in spirit and like to be treated as human beings. They will go the limit for an employer whom they respect. Bridge and building men have no regular hours. They work until the job is done. There are no more loyal men in the world than your men who work at washouts and emergency work because then they see the necessity of strenuous action, but in our routine handling of work, men are not inspired with the same enthusiasm.

It should be remembered that men are just what you make them. When a foreman says that men are not as good as they used to be years ago, he is simply admitting that he is more less incompetent. It is true that rates of pay do not always attract the best men but human nature has not changed and it is just as possible to have a good enthusiastic organization today as it was thirty years ago. The remedy is in our hands. If we expect our men to cooperate with us in carrying out our work, we must show by our disposition and actions that we are ready to cooperate with them. As a matter of fact, we should make the first move. Men naturally look to their officers for advice and initiative. If you supervisors do all that you can to promote the proper attitude in your organization, you will find a hearty response. A proper mental attitude is the cause and enthusiastic cooperation on the part of the men the effect.

Therefore, it seems that along with your discussions of material, tools and methods, you can well afford at times to discuss the human question. It is one of the biggest fields. We are lagging behind the industries in that respect. In addition to a knowledge of technical details, it is essential that any officer should study human nature and find out how to get the best results from his men just as he figures the proper design for his structures. When that is done, we will not only have a more effifficient force, but each man will be more contented. When men are enthusiastic, your work is a pleasure.

Report on the Relative Merits of Steel and Wood Sash

AMONG THE important factors to be given consideration in the designing of railway buildings are those of daylight and ventilation. These can be furnished by the use of window sash, except in large station buildings, where the ventilating system is mechanical. As a certain per cent of the sidewall area should be in glass, an economical arrangement for ventilation can be obtained by the use of the movable sash. With poor lighting and ventilation unpleasant working conditions exist and the labor efficiency becomes low. In planning a large railway building so that the sash and floor layout fit each other, to utilize the ventilating possibilities of the sash the following points, in particular, should be considered:

The inlet and outlet openings must be properly balanced as either is useless without the other.

A weak ascending air current will not drag a long horizontal air stream.

Such air as enters from the side sash openings escapes before reaching the center of the building if the roof sash is poorly controlled, and remains stagnant if the roof sash is closed. Proper air circulation is an important item in any building.

When the roof is used for ventilating it must be formed to stimulate air movement, so that the air does not pocket in the peak.

From the standpoint of light, a wooden sash will admit less light than steel sash of the same sized opening, because of its bulkier lines and type of construction. Steel sash has fewer and thinner supporting members, giving less interference with the supply of light.

For ventilation, top hung sash of steel, in the proper type of roof construction, forms a natural outlet for smoke and gases and at the same time does not have the limitations of wood sash in that it may have to be closed for rain storms.

Steel Sash

Steel sash includes solid steel sash, hollow metal sash or a combination of these types. Solid steel sash with ventilators are being used extensively for large terminal buildings of fireproof construction. Solid rolled steel, continuous top-hinged, monitor sash has a storm panel at the ends of each operating run. By the use of mullions any desired opening can be obtained. In the case of side walls the window openings in large buildings are generally made to fit uniformly between pilasters or supporting columns in steel frame construction.

The intersection of the horizontal and vertical muntin of solid steel sash is formed by a dovetailed miter interlocking of bars so they run continuously from the head to the sill and from jamb to jamb of units. This construction offers the maximum strength against wind pressure and vibration.

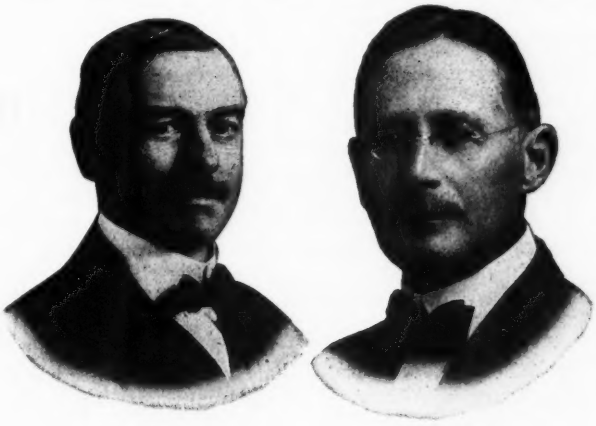
Metal sash is installed in a prepared opening in the wall. Offset jamb construction is essential for single unit openings, and is very desirable when multiple units are to be used as it facilitates installation. Being usually ordered from stock it is made to fit into walls without a special frame. For one story shop buildings covering a large area, one of the best methods of daylighting and ventilating is to use the sawtooth roof construction with steel top hung sash. The South originally introduced the sawtooth or northlight roof and it was extensively used for a long time in localities where little or no snow fell. With the use of steel sash, the leakage around the window muntins and sash, when snow collected and melted was overcome. This type faces, generally, to the north and slopes at an angle of from 25 to 30 deg. with the vertical, depending on the latitude, the steeper pitch being used in the southern states.

Sawtooth steel skylights have operating sash by which the upper section, when hinged at the top, can be opened for ventilation. With this type the ventilating feature does not interfere with the daylighting. Instead of having a spotty outflow due to individual openings which causes an irregular distribution of fresh air, a uniform distribution can be obtained

by operating the roof sash simultaneously in groups by electric motors and by providing corresponding uniform inlets in the sidewalls by means of continuous sash. Where considerable daylight is required, free from shadows and direct sunlight, this type gives adequate service.

With operating devices monitor sash is made in the pivoted, continuous center pivoted or continuous top hung types for use in railroad buildings. Hollow metal sash is made as a double hung, hinged in, stationary, standard pivoted, double pivoted or a combination of these types; also with a vertical and horizontal swing of one or both sashes. All sash are made with dies which insure the fitting of every member when assembled and welded at the joints. This construction assures a warmer building, being built of hollow sections with continuous air spaces and eliminates condensation and affords the maximum of light.

For hollow metal windows the jambs, heads and sills are constructed so there will be no openings or holes entering the hollow chambers that would permit moisture to enter and start corrosion from the inside.



C. A. Lichty
Secretary-Treasurer

F. E. Weise
Assistant Secretary

The sills are reinforced with a subsill of galvanized sheet iron, with walling-in flanges on the jambs and water bars on the sills. These sash are mounted in frames between double weather stops, stops being adjustable so that they may be placed in the closest relative position with respect to the sash.

Each unit of steel sash is shipped from the factory or warehouse in perfect condition, but should be inspected before installation. Improper handling during transportation will bend some members of the units. They should always be stacked on edge. To facilitate movement from place to place never turn units on their corners, nor drag the units about or pile them one upon the other as this bends the members and tends to distort the sash frame. It is designed to stand maximum wind pressure and vibration but not to support any building construction, nor act as a lintel for concrete, brick, steel or wood.

Window openings should be prepared, generally, before the sash are placed. Some construction will allow placing the sash in position as the walls are built, especially when being built of brick or concrete blocks. Steel sash must be erected plumb and level regardless of the contour of the opening itself.

The rebates and grooves in the head sill and jambs of the structural openings are prepared to conform with the sash to be installed. When the sash has been placed in the prepared opening and the anchor leg has been entered in the proper grooves at the head, sill and jambs, the unit must be alined and plumbed before the grouting and pointing is done from the interior. Small hardwood wedges are most satisfactory. All blocking is done from the inside.

Installing steel sash in connection with structural steel construction has brought about the standardization of head, sill and jamb details. In this construction a small I-beam clip is used to hold the units in place at the head and jambs. A strap anchor fastened to the sill member of the sash secures the units to the structural work at this point. All punching of the structural steel for the structural steel attachment should be done when the steel is fabricated. Punching in the field delays installation and increases the cost.

In reinforced concrete buildings the steel sash is placed with the frame entering the form sufficiently to seal it entirely from the weather. With concrete window sills an advantage is obtained by pouring after the sash is set, giving the bottom of the sash frame an entire seal which eliminates the effect of the weathering. This allows a wash slope to be made to take care of the run-off. This can apply to buildings of brick, concrete, and concrete block construction. Pre-cast sills have not been found satisfactory. For square head windows, mullions should be attached to the steel with angles and bolts. This makes a very rigid construction for the sash.

Wooden Sash

Wooden sash used in frame, brick, frame and stucco, and concrete block buildings may be of white pine, cypress or redwood depending on the section of the country in which they are located. Frame buildings, which are the ordinary type of railway buildings of non-fireproof construction, have a rigid opening for the installation of the sash frame. This frame as well as the sash should be made of thoroughly dried lumber to avoid shrinkage which would otherwise occur. The frame opening should be of sufficient size to allow the sash frame to be set plumb, facilitating the easy operation of movable sash.

In the average railroad building wooden sash will generally be double hung, if in sidewalls, and probably center pivoted if used in the roof. Under unusual ventilating conditions the smoke and gases must pass out of the highest part of the building. Center pivoted sash do not permit easy egress.

Monitor wooden sash should be either pivoted, continuous center pivoted or continuous top hinged with proper sash opening devices to give best results. In machine shops a wooden sash operating device can be of the worm and gear type turning a rocker shaft, to which are attached arms that in turn act directly on the sash through suitable rods. A rack and pinion gear is used primarily for long runs of heavy hinged-top sash. The direct horizontal thrust given to the sash prevents harmful strains.

In brick buildings the wooden frame is first set plumb in its proper location and then bricked in. A metal lintel or flat arch at the top of the frame generally relieves it from any pressure due to the construction above it. When the walls have thoroughly set the finished sash are hung in place and their operation tested. With a plumb frame the sash can be installed easily and good results can be obtained whether it be of the fixed, sliding, tilting or revolving type. By the use of copper weather stripping, this type of sash can be made weather tight when closed, which saves heat and excludes dirt and dust. This is

used on windows of depots and office buildings in sections where cold winters occur.

In wooden sash installations the frames are generally received on the job before the sash. Sash should always be glazed before shipping, which results not only in a saving in time but also in cost as the sash manufacturers are better equipped to furnish a complete unit. Sash pulleys should be quickly detachable, galvanized finished, specially bushed and noiseless. Either sash cord or chain can be used with cast iron sash weights. The use of the above will facilitate the easy operation of sash in the different types of buildings. Wooden frames possess an advantage in that they make it easy to apply curtains, storm sash and screens.

Conclusions

Wooden sash can be used economically in buildings where the inside temperature is more or less uniform and where smoke, gases and moisture are present, which have a deteriorating effect on steel sash.

In frame, and stucco, concrete block and brick buildings where the use of shades, screens and storm sash is necessary, wooden sash allows the easy installation of fastenings. For all other types of buildings steel sash is well adapted for use and has the additional advantage of fireproof construction.

Steel sash used in engine houses or power houses should be scraped and painted at least every other year to overcome the deterioration resulting from the effect of smoke and gases. In other buildings painting is generally done with the other painting.

A maximum glass area is provided by the use of steel sash which may require more frequent painting than wooden sash. It reduces fire hazard but its protection becomes ineffectual when the glass melts.

Painting wooden sash is not required as often as for steel sash since even if the paint is entirely gone, leaving the wood bare it does not affect the sash.

Since the quality of lumber for sash purposes is diminishing, wooden sash will require a substitute which will be a new type of metal sash with frame.

Shrinkage, which is typical of wooden sash and casings is entirely eliminated by the use of metal sash, hence buildings are easier to heat in winter as well as easier to ventilate, for ventilators can be opened regardless of weather conditions.

For general use in various buildings, sash of extra heavy white pine, well painted and glazed, with good putty, will make an economical installation.

Committee: F. N. Graham, assistant engineer, D. M. & N., chairman; A. T. Hawk, engineer buldings, C. R. I. & P., vice-chairman; P. Aagaard, general building inspector, I. C.; F. H. Masters, assistant chief engineer, E. J. & E.; and J. D. McMahon, architect, G. N.

Discussion

Although this report covered the use of sash in railway buildings of various types the discussion centered almost entirely around their use in enginehouses because of the severity of the service there. It was evident from the discussion that wooden sash were favored by the majority for use in buildings of that type. C. Ettinger, (I. C.) favored the use of sash of cypress, although he did not recommend this timber where it is necessary to renew glass frequently. He realizes that wood sash must eventually give way to steel but pointed to the difficulty in overcoming the effects of vibration and settlement by "easing off" steel sash, whereas wood sash can be planed down.

F. A. Taylor, (B. & O.) reported that he has found much more glass broken in steel sash than in wooden sash. T. Turnbull, (Ann Arbor) and B. A. Guill, (Ga. R. R.) also favored wood sash as more economical than metal for roundhouses. On the other hand, F. C. Baluss, (D. M. & N.) stated that in a roundhouse built seven years ago in which wood sash were used in a sawtooth roof and steel sash in the vertical walls, the steel sash are still in good condition, although all of the wood sash are now being replaced. While the wood sash has been exposed to more severe service, he stated that as a result of this experience he would use steel sash throughout if he were to build another structure of this character. He emphasized the fact, however, that steel sash must be kept well painted.

In discussing the use of steel sash for office buildings, M. Kane, (D. & H.) stated that in a general office building erected at Albany, N. Y., 10 years ago 40 per cent of the steel sash are now being reinforced with steel plates to overcome the effects of corrosion P. Aagaard, (I. C.) favored the use of steel sash to conform to the architectural requirements of the more important buildings and advocated the use of T-bar designs in permanent construction where settlement is anticipated. He opposed the use of metal sash in roundhouses in general but has found that they are advantageous in Southern climates where they permit better ventilation.

The Reduction of Accidents to Employees

AN EFFORT to reduce accidents to bridge and building employees will have but little effect until every member of the department learns to think in terms of safety and to know that the safe way of working is the only right way. To instill this idea requires safety organization. Except on a few roads the safety work among bridge and building men will be handled with that of the trackmen under the division engineer. An engineering or maintenance of way safety committee will usually have the division engineer as chairman and as members the roadmaster or supervisors, master carpenter or supervisor of bridge and building, and a number of foremen and workmen. The officers should hold office continually but the foremen and workmen should change about every six months so as to eventually give all a chance to learn and serve in the work.

These committees, which should meet at a regular time each month, will consider the last month's accidents in the department and methods for preventing their repetition. One or two phases of the work should be brought up each month and an effort exerted to lead the foremen and men to express their ideas on safe practices.

Handling and Storing Material

The accident statistics of the Interstate Commerce Commission show that maintenance men meet with many accidents in the handling of material. The accidents from this cause can be reduced and often eliminated by proper supervision and equipment. About one-half the sprains and strains suffered by the men in heavy lifting are due to failure of the men in the gang to work in unison. Here the foreman or gang leader should have the responsibility for seeing that the men work together. More care is usually required in releasing the load than in picking it up. Another point to be observed in the

handling of material is the safe way to take hold. The men should grasp in a way that the hold can be maintained, and that their fingers will not be pinched by the load. Men handling reinforcing bars and other rough material should wear gloves to protect the hands.

Cranes should be operated only by regular crane operators or authorized substitutes who have been trained under the supervision of a competent operator. No one else should be allowed to enter the cab. No person should be allowed to operate a crane whose eyesight or hearing is defective, or who may be suffering from heart disease. A physical examination should be required at least once a year. The operator should familiarize himself fully with all the crane rules and with the crane mechanism and its proper care. The crane should be examined each day for defects before starting work. The operator should recognize signals only from the one man who is supervising the lift. Operating signals should follow an approved standard. They should be manual and never verbal.

The committee submits the following recommendations for signals for the operation of cranes.

Standard Locomotive Crane Signals

1. **Hoist.**—Forearm vertical. Make small horizontal circle with the hand.
2. **Lower.**—Arm extended, hand below hip, wave forearm downward.
3. **Stop.**—Arm extended, hand level with hip. Hold position rigidly.
4. **Emergency Stop.**—Arm extended, hand level with hip. Wave hand quickly to right and left.
5. **Raise Boom.**—Arm extended, fingers closed, thumb up. Jerk arm upwards.
6. **Lower Boom.**—Arm extended, fingers closed, thumb down. Jerk arm downwards.
7. **Swing Boom.**—Arm extended, fore-finger indicating direction of swing.
8. **Open Clamshell.**—Arm extended, fingers half closed. Open fingers to open clamshell.
9. **Close Clamshell.**—Arm extended, fingers half closed. Close fingers to close clamshell.
10. **Travel Ahead Away From Signalman.**—Arm extended fingers open. Make small vertical circle clockwise with the hand.
11. **Travel Back Towards Signalman.**—Arm extended, fingers open. Make small vertical circle counter-clockwise with the hand.
12. **Stop Travel.**—Arm extended fingers open. Move arm quickly up and down.

Falls of Persons

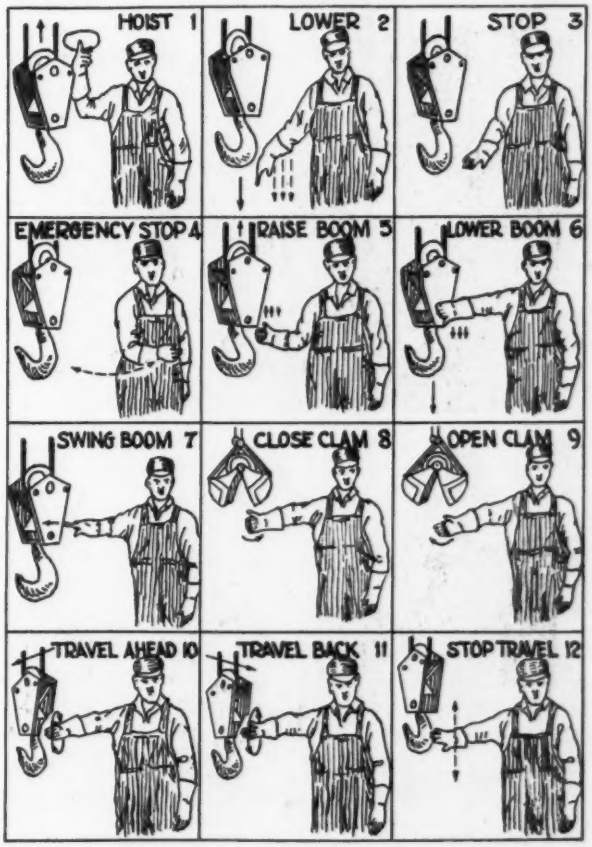
Falling and slipping cause a great number of accidents among bridge and building men. Most such accidents are due to the personal carelessness of the men. Here the foreman and supervisory officer can help by always watching the men and cautioning them to be careful where they step. The men can make their workplace much safer by keeping it clean. Tools and unused materials should be kept out of the way. Men should be continually cautioned about leaving boards about from which nails are protruding. On bridge jobs where there is a high fill there is eventual economy in digging steps in the bank for the men or in constructing a good stairway with a railing. Runways for wheelbarrows should be sufficiently wide and well supported so that there will be no danger of a man falling off should he momentarily change his balance with the load.

Many men are injured by falls and slips while several are working together handling heavy material. When such material is being carried the foreman should caution the men to watch their step and to keep in step. Men should not be required to walk backward when there is danger of mis-stepping.

Care should be taken to observe safety rules around work train equipment. Men should get on and off cars only when they are not in motion. Safety railings should be provided where possible on derrick cars. The cars used with work trains should have the standard safety appliances required by the Interstate Commerce Commission, and additional ladders and grab irons at the doors where the men enter. In the winter snow and ice should be removed from platforms and other dangerous working places. All icy places should be sprinkled with sand to reduce the danger of slipping.

Ladders and Scaffolds

Cases of the collapse and falling of ladders and scaffolds and of men falling from them do not furnish a great proportion of bridge and building accidents on



Standard Signals for Locomotive Crane Operation.

many of the roads, but those accidents thus caused are usually severe and sometimes fatal. Accordingly every effort must be put forth to insure safety in this work above the ground. The supervisory forces should see that proper and safe appliances are furnished for the work, that they are placed and erected safely and that the men work with necessary caution for themselves and others while on them.

In using ladders care should be taken that there is sufficient clearance. Eight inches behind, 36 in. in front and 15 in. on each side of the center line are safe requirements. The ladders should not be too straight or too flat. The bottom should be secured against slipping by the use of safety bases. In some cases the top should also be secured. Men should always face the ladder and use both hands in climbing. Men should not work on ladders nor scaffolds during high winds.

Scaffolding should be erected and taken down only by

The Convention Party Found Much of Interest at Niagara Falls.

experienced men. It should be strongly constructed for the work in hand. Care should be taken not to overload scaffolds with men or materials. They should be kept clean of all rubbish and such tools as are not in use. Nothing should be thrown from the scaffold. Material should not be dropped onto it nor should men jump on it. In the winter the scaffold and all working parts should be cleaned of ice and snow and sprinkled with sand or ashes before starting regular work. When working high the men should learn to watch every step and always be secure against loss of balance.

Hand Tools

On one of the large eastern roads 22.7 per cent of the injuries in 1924 to certain representative classes of bridge and building men were due to the use of hand tools. The accidents causing such injuries may be eliminated by providing proper tools, keeping them in good condition, allowing only suitable tools to be used, and seeing that the men handle the tools in the proper manner.

Every effort should be made to see that the stores department provides tools of the kind needed for the work in hand. Improvised tools may be necessary on occasions, but as a rule it is safer and more economical to use the right tool for the job. The material for the tools should be of a quality suitable for the work to be done. The face of striking tools should have the proper temper and this temper should be maintained when the tools are refaced. The handles should be smooth, solid and straight grained and securely fastened to the head of the tool. Flying heads have caused a number of serious accidents. Extra handles should always be available for sledges and picks and the new ones should be fitted by an experienced man.

Cold chisels and drill steels should have a holding device so that they need not be held in the hand. Steels with mushroomed heads should not be used. Wrenches of the various types and sizes needed should be furnished. Their use as hammers should be forbidden. A sufficient supply of all edged tools should be provided so that there will be no hesitancy in sending tools for repairs for fear of an insufficient supply on the job.

Goggles should be provided for use in all operations where there is danger of eye injury from flying particles. The glass in the goggle lenses should be perfect. Goggles of clear glass may well be provided for the use of motor car operators to keep wind and dust from their eyes. Welders should wear the approved dark colored goggles or helmets when operating. For sanitary reasons each man should be provided with his own pair of goggles in a metal case. They should be fitted to him and he be instructed in their use.

Lifting jacks are in quite common use around bridges and buildings. They should be of sufficient strength for the work in hand. The jack should be properly centered under the load using a piece of wood over the head of the jack when necessary to prevent slipping. Men must keep clear when the jack is released. Jacks should be set on a solid footing and braced if necessary to keep plumb. Men should keep out from under objects supported only by jacks until horses or blocking of sufficient strength are in place.

Certain men may be found on the force who seem to habitually drop tools and material. This is especially dangerous when they are working above others and if they cannot mend their ways they should be placed in another kind of work or discharged. Even when not in use, some of the hand tools are a source of danger. They should always be kept in place so no one will trip

over them, be cut by them, or they will not fall on anyone.

Care must be used in handling wrenches. One too large for the nut may slip. The wrench should face in the direction of turning. The teeth of pipe wrench jaws should be kept sharp. Wrenches should not be used as hammers.

Handling timber has been found to be the cause of numerous accidents among bridge and building men. Part of these accidents are due to improper tools or the improper use of these tools. Cant hooks should be sharp and have the metal part well secured to the handle. In rolling a timber the man should preferably work from the end so nothing will catch his legs. Men working with an adze should stand with their legs well spread and should grip the handle so firmly that they will not be hit if the blade catches on the edge.

The Personal Factor in Accidents

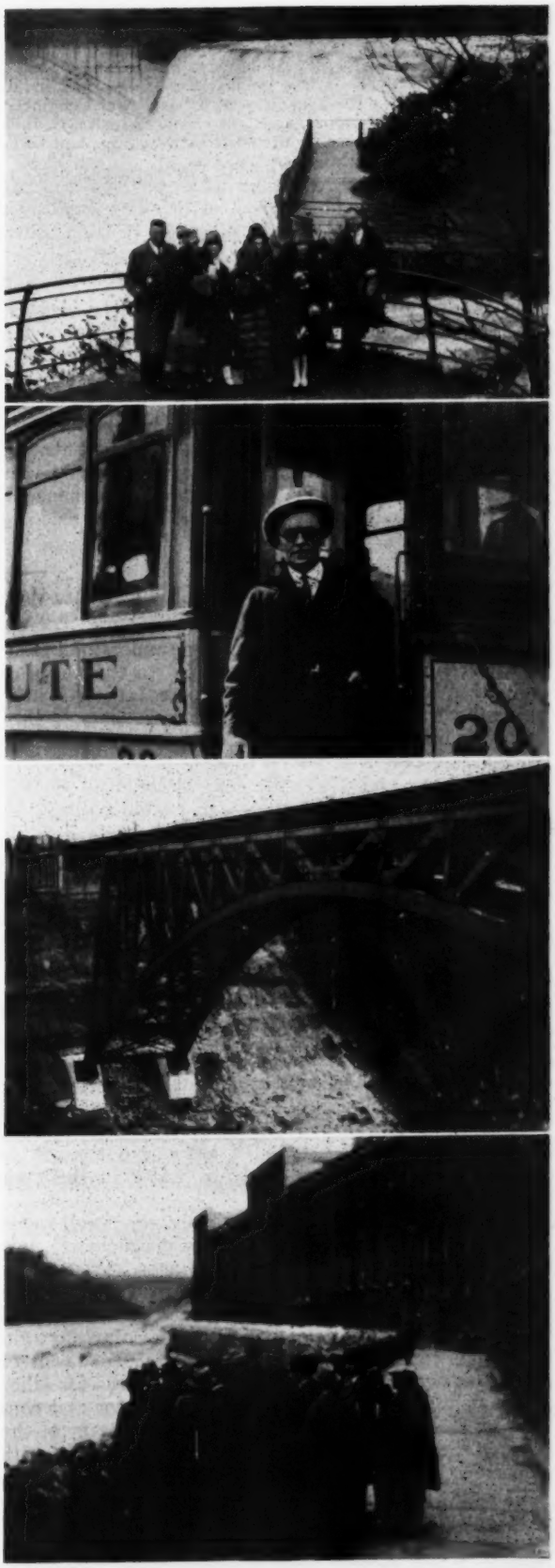
Even a casual study of accidents will show that there are certain human tendencies toward or in avoidance of accidents which seem hard to explain. Certain men who may not appear at all careless have been the victims of more than one accident. Others will take foolhardy chances every time they are out of direct control. To reduce the number of accidents among these and certain other types requires earnest study and work on the part of the safety supervisor and the supervisory forces.

A poorly equipped mind is just as dangerous and possibly more dangerous than an unguarded machine or scaffold. These dangerous, ill-equipped minds might be classified in several ways, but primarily they will be unguarded minds of ignorance, the misguided minds, the stubborn minds and the involuntary minds. These four principal types will be briefly reviewed for easy recognition and a study of methods of overcoming the risks that they involve.

Ignorance is the cause of many of the accidents among unskilled workers. A much larger accident rate is found among workers in the first few months of their employment. Some of them have not been properly instructed. Others did not understand their instructions because they did not understand the English language. A worker must not only be told the right way of acting, he must be taught it. Certain men will be found who are actually mentally deficient, but they can be taught such safety habits as to keep from under loads on cranes and away from passing trains.

In speaking of the misguided mind we refer to the mind that does not comprehend accurately from the physical senses such as sight and hearing and that does not get the proper response in the muscles in acting. Defective vision may make a man misjudge the speed of moving machinery or stumble over an obstruction. Physical examinations may find this ailment but often our men are not given such examination. Defective hearing may make a man heedless of warning sounds or shouts. Others may have such a poor sense of balance as to be dangerous to themselves and others when working at heights. Certain men are of such excitable temperaments that a hurried move may cause an accident. In contrast to this is the tired mind and body that gets out of the way of danger too slowly. The safest man is neither too responsive nor too sluggish.

In appealing to men with safety work and other measures, types of stubbornness will be found with which it is hard to deal. The leaders in safety work had first to attack cheerful recklessness among a large group of our workers. When persuasion fails, discipline may be required to cure these offenders.



The New Michigan Central Bridge Across the Gorge Was Studied With Much Interest.

Committee: F. C. Baluss, bridge engineer, D. M. & N., chairman; A. O. Ridgway, chief engineer, D. R. G. & W., vice-chairman; F. A. Dever; B. S. Mace, superintendent insurance, B & O.; H. A. McElhinney, bridge and building master, C. N.; P. H. Carlson, supervisor bridges and buildings, I. C.; D. Rounseville, assistant chief engineer, C. & N. W.; C. J. Scribner, assistant engineer scales, C. B. & Q.; J. S. Sharp, engineer maintenance of way, Sou., and G. E. Thomas, engineer of bridges, A. C. L.

[The committee's report included sections on safe motor car operation and safety in handling explosives and inflammable which will be presented in later issues. —Editor.]

Discussion

In presenting this report Mr. Baluss emphasized the fact that although the number of accidents among railway employees has decreased materially in recent years there has been no decrease among those employed in the bridge and building department. In marked contrast to this condition he stated that there have been no reportable accidents in the bridge and building department of the Duluth, Missabe & Northern during the entire year of 1924. P. Hofecker, (L. V.) described the manner in which he had induced the men under his supervision to use goggles for certain operations. He has prepared a form which the men are required to sign, agreeing to use goggles for specified duties and accepting full responsibility for accidents resulting from their failure to use them. C. Ettinger, (I. C.) emphasized the necessity of supervisory officers giving more attention to the training of new men in their gangs in safe methods. On the other hand, Mr. Hofecker stated that he has found that many accidents also occur among the older men who become careless.

That portion of the report relating to the operation of motor cars received special attention. E. E. Clothier, (C. M. & St. P.) stated that his road has abandoned all signaling devices on motor cars as their experience indicated that they were not effective. Instead they require all cars to run under complete control across highway and farm crossings. In reply it was pointed out that the laws in a number of states require that motor cars be equipped with warning devices. The discussion also indicated that many accidents occur through failure of the draw-bar connecting the motor car and trailer and several designs of draw-bars were described to overcome this difficulty.

Report on Electrically Operated Pumping Plants

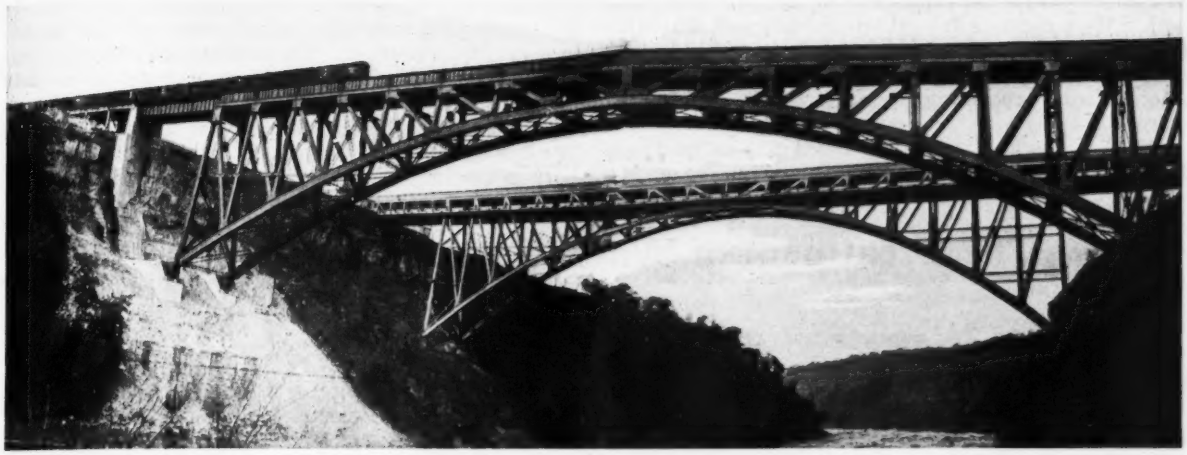
ALTHOUGH it was generally understood that electric power was well adapted to the needs of railway water stations, it has come into use in a general way only during the past few years. Two factors combined to restrict the use of motor driven units: The points at which reliable power was available were few and where the current could be secured the rates were usually too high to enable a saving to be secured. However, in recent years, especially during the past four or five, we have witnessed a great expansion of power companies' lines, so that electric power at a favorable rate is available at an increasing number of railway water stations. Many of the smaller municipalities are now able to furnish both cheap and reliable power due to the development of the Diesel engine.

An ideal water station should be equipped with a pumping unit that will keep the tank full of water at all times with a minimum amount of attention or supervision. The electrically operated station is often well suited to fulfill these conditions and when controlled by a pressure governor float switch located in the tank or other type of automatic control, is usually able to keep a supply of water in the tank and requires little attention.

The advantages of an electrically operated water station may be: Low first cost, low maintenance, low cost of operation, safety and cleanliness. When considering a new water station the electrically operated unit holds a decided advantage over other methods of pumping in the matter of housing as a complete unit, including control, requires only about 30 per cent of the space occupied by the equipment required for other methods. The average cost of pump, motor and control of a large number of stations in all parts of the United States, using various types of pumps with capacities varying from 100 gal. to 600 gal. per min. is about $1,100. This will compare favorably with a steam plant or an oil station when the cost of fuel storage is taken into account. The maintenance of a well installed electrical unit is usually low. While the motors are reliable they are not prime movers and unless provision is made for different sources of power, which is usually impossible, secondary pumping units should be installed. A number of railways follow the practice of leaving in place the original unit as a standby. Others provide oil burners. Unless the storage of water is sufficient to provide for the maximum demand for a period of at least 24 hours, a secondary pumping unit should be installed and kept ready for service. This will provide for the shutting down of the electrical unit for inspection and repairs. It is also possible where ample storage is provided to make arrangements with the power company so that the pump can be operated outside the periods of peak load. Frequently a more favorable rate for power can be secured when this is done. One serious obstacle in the proper maintenance of electrical equipment is the lack of familiarity among the water supply forces with electrically operated equipment. Generally speaking, the electrical maintenance is handled by the mechanical department and not by water service employees while the usual steam and oil engines are regularly maintained by the water service forces.

The cost of operation of an electrical station depends almost entirely upon the cost of power. The sliding scale basis, the cost per kilowatt hour decreasing in proportion as the amount of current used increases, is universal. In addition, there is usually added a demand or service charge although this latter charge is sometimes omitted. The largest item of saving due to electrical operation is in attendance, practically every installation showing a decrease in this item. It is necessary, even with automatic control, to have some attention given to the plant. This can be done by signal maintainers, pump repairers, telephone maintainers or other local employees. A small increase in the salary of the employee is given for this work. The actual average saving per month for 20 representative stations, as shown by reports received, was $86, due principally to the reduction or elimination of attendance.

In cleanliness the electrically operated station stands supreme. No expense need be incurred for fuel storage, thus doing away with the expense of handling and storing coal, oil or gas. With the various types



The Michigan Central Arch and the Grand Trunk Arch (in the rear) Span the Head of the Rapids Gorge at Niagara Falls.

of safety devices and controls now on the market there is little danger in the operation of electrical units. Lightning arresters should be installed, a safety switch equipped with fuses to prevent overload is necessary and all the wiring inside the pump house should be placed in conduits. With the float switch type of control a short-circuiting switch should be placed in the pilot circuit to enable the pump to be run for a brief period when making an inspection even though the tank may be full of water. When a pressure governor is used an air tank of suitable size, tapped into the discharge line, is necessary. This tank should have an air inlet, a drain and be fitted with a water gage glass extending the full height of the tank. This tank will overcome the excess pressure due to surge when starting or stopping the pump.

One disadvantage of the electrically operated outfit, especially in northern latitudes, is the danger of freezing. While the exhaust from a steam plant can be piped to points where necessary to prevent freezing, a small electric heater, a stove or an oil lamp is necessary with the electrical unit. With the float switch type of control, freezing can be prevented by adjusting the limit of draw-off so that the pump will operate every time water is taken from the tank. One railroad reports the installation of a small drain pipe, so that there is a continuous flow of water through the line, thus preventing freezing.

Another disadvantage concerns the matter of dependability. Where electric power is used the source is almost always outside the control of the water service forces. Any interruption in the service is liable to cause a serious shortage of water unless secondary units are ready for service or ample storage has been provided.

While the motor drive is being used with every type of pump it is particularly suited to the direct connected centrifugal pumping unit. The pump should be of the double suction, horizontally split casing type, direct connected through flexible couplings on the same base to the motor. This type of pump has been improved and can be secured in a wide variety of sizes. While the efficiency of some centrifugal pumps is low when compared with other types the committee feels that its advantages should be considered. Its first cost is low, it occupies little floor space, has few parts requiring repairs, is easily maintained and can be operated over long periods without the necessity of shutting down.

The committee feels that where conditions are favorable, and at points where electric power can be secured at a reasonable cost the electrically operated stations are cheaper to install and maintain than steam plants. Although it is generally understood that fuel oil engines furnish the cheapest method of power pumping they can be offset in some instances by the decreased cost of attendance of electrical stations. When considering the installation of a pumping station stress should be laid on the necessity of considering each point strictly on its merits. Estimates should be made of the cost of housing, of pumping by various methods and the type of power used which will give the service required at the minimum cost.

Committee: J. M. Fitzgerald, office engineer, C. of G., chairman; E. P. Hawkins, division engineer, M. P., vice-chairman; A. L. McCloy, supervisor water service, P. M.; O. C. Anderson, foreman water service, S. P.; M. P. Blake, superintendent water service, C. N. R.; D. D. Everett, foreman water supply, Erie; F. M. Case, foreman water service, C. & N. W.

Discussion

The economy of electrically-operated water stations was illustrated by the statement of A. L. McCloy, (P. M.) to the effect that he has installed six of this type stations this year which are estimated to save $5,000 annually.

The discussion of this report centered largely around the necessity for the retention of the old pumping equipment for emergency use. A. B. Scowden, (B. & O.) stated that it is not the practice on that road to retain the old pumping plant as the power failures are no more serious with electric operation than with steam He reminded those present of the not infrequent necessity of taking old steam plants out-of-service to renew boilers, etc. C. R. Knowles, (I. C.), on the other hand, advocated the retention of the old plant as a secondary unit as a desirable precaution He cited an experience on his road where the destruction of a bank of transformers by a severe electrical storm caused the electrical unit to be shut down for ten days. L. C. Prunty, (U. P.) called attention to the fact that the credit value of the old material released is slight, while its value as substitute equipment may be great in case of an emergency.

A. I. Gauthier, (B. & M.) reported trouble in the operation of remote control pumping stations because of the lack of supervision of the engine and stated that he has also recently removed automatic control at some stations because of the freezing of the float switch, causing it to fail to shut off the pump at the proper time. C. R. Knowles, (I. C.) has overcome this by placing the float

in a small pipe in the center of the tank which is filled with a light non-freezing oil which rises and falls with the water He stated that it is possible to secure control panels that are practically fool-proof, providing they are selected with proper consideration of the service required.

W. T. Krausch, (C. B. & Q.) stated that his road now has 35 to 40 electrically-operated stations in service. As a result of this experience he emphasized the necessity for giving each station individual study prior to the selection of the equipment The extension of the eight-hour day has forced the reconstruction of many plants and the installation of larger pumping units. Where electrical equipment has been installed he has found it necessary to educate the men in the use of this equipment, particularly in handling emergency breakdowns.

The Treatment of Water For Locomotive Use

By R. C. Bardwell

Superintendent Water Supply, Chesapeake & Ohio, Richmond, Va.

THE QUALITY of water supply is closely associated with the operating efficiency of a railroad, and its result is of vital interest to the management, as well as to all departments. Of the 350 billion gallons of water which are now being used annually for steam consumption on American railroads, it is estimated that 50 billion, or about 15 per cent, is receiving treatment in some form. At a general average cost of 4 cents per 1,000 gal. for treatment, the yearly operation expense involved is in the neighborhood of $2,500,000. There are approximately 1,200 water stations out of a total of 16,000 where chemicals are added, and the total investment in softening plants, including the inexpensive as well as the elaborate types, is at least $10,000,000. It is estimated that these plants are removing 100,000,000 lb. of scale-forming solids annually, which, if allowed to enter the locomotive boilers, would represent an additional expense in locomotive operation and maintenance of approximately $13,000,000.

The Quality of the Water

The water in streams, as well as ponds and small lakes, is subject to seasonal fluctuation. During wet or stormy periods the heavy mud and sediment carried, indicate from visual inspection, the need for improvement. During dry seasons and low water stages, the water may be clear but the influence of the dissolved minerals is much more severe. As a rule, well waters are clear, but frequently hard. This may not be objectionable for drinking purposes but necessitates treatment for economical use in locomotive boilers.

There are two general classes of minerals which dissolve in the water; (1) those which cause scale and pitting, which include the acids, and (2) the alkali salts, such as common table salt. It must be understood that the minerals referred to are those carried in solution which cannot be seen and do not settle out. The mud and such material as is occasionally washed down into the creeks cause only a temporary condition and gradually settle, but the soluble minerals remain until forced out by chemical action.

When water is taken into the boiler, steam is generated which is pure water in the form of a gas. Thus, the pure water goes off through the exhaust and the minerals are left behind. At the high boiler temperature, the scaling matter is not soluble and crystallizes out as a hard coating on the tubes and sheets. If any acid is present, the heat helps it to act rapidly on the tubes and sheets and starts pitting. The alkali salts do not necessarily cause scale or pitting and they are very soluble so they just keep on accumulating until the water gets sticky and has to be blown out.

The scaling salts are divided into two general classes. The most important, and the type which causes the most damage, is the sulphate or "gyp" scale. These are the minerals which are soluble at ordinary temperatures but soon reach their saturation point at the high boiler temperatures and crystallize out as a hard, flint-like scale. The "lime" or carbonate scales are of the softer variety, although frequently present in large quantities. If the sulphate or "gyp" scale is absent or eliminated so that the hard binder effect is removed, the lime scales do not cause such serious damage to the equipment other than gradually to clog up the water space or make the water dirty with the possibilty of a mud burn which requires, for prevention, more frequent washing or blowing down.

The most common form of pitting is the result of the presence of sulphuric acid from pollution by drainage from coal mines. The sulphur present in coal seams frequently oxidizes to the extent where sulphuric acid is formed and the action of this acid on iron and steel is well known. Other forms of pitting are due to mechanical defects such as improperly matched sheets with non-uniform tension, or improper care of materials, such as using steel which has been permitted to lie out in the weather without protection and on which atmospheric corrosion has already started. In the western sections where it is necessary to use waters containing large amounts of alkali salts, serious pitting has been experienced due to the increased electrolytic conductivity or action of such waters.

Boiler Foaming and Its Cure

"Boiler foaming" is one of the most aggravating complaints which occur with railroad water supply. This is the result of a condition of the water surface in the boiler which does not permit the steam bubble to break free and when these bubbles build up to the throttle opening, water is carried over with the steam. The situation is analagous to a coffee pot boiling over. Locomotive cylinders are built to operate by steam pressure and their operating efficiency is immediately destroyed by the presence of water. The foaming condition is caused by a combination of two things: (1), a heavy accumulation of the soluble alkali salts, and (2), the presence of mud and suspended matter such as loosened scale. The situation can be very largely controlled by properly conditioning and clearing the water before it is delivered to the locomotives and by regulating washouts or water changes or by the occasional use of the blow-off cocks which removes the suspended matter and reduces the alkali salt concentration. Where foaming troubles exist, it is an indication that the situation is not being handled properly.

Water treatment of some kind is probably as old as

steam boilers. It has developed from the introductory stage of adding some material direct into the boiler to the present refinement and, in some instances, of complete softening and final filtration before the clear, safe water is delivered to the locomotives.

The oldest and probably best advertised water treatment is the addition of boiler compound or chemicals, such as soda ash, direct into the engine boilers or tanks. This process has been improved and cases where the material is added in solidified form which dissolves slowly, either in the boiler through the washout holes, or in engine tanks, and in some cases, in the roadside tank or pump discharge line, have shown good results on water of moderate hardness. The disadvantage appears to be largely in the lack of a dependable system for checking the regularity and properly proportioning the treatment.

Soda Ash Treatment in Roadside Tanks

The least expensive systematic treatment from the standpoint of first cost is the addition of soda ash to the water in the roadside tanks so that all of the sulphate or hard scale-forming matter is softened. This practice is followed extensively on the Wabash, the Chicago & Alton, the Frisco, and to some extent on many other roads. With careful supervision and close and systematic check, it can be made to give satisfactory results, but it has the disadvantage of producing acute foaming conditions with the incident interference with train movement, where the concentration in the boiler is not maintained within workable limits by frequent blowing down, so that it is held in bad repute in many localities.

Several means are used to proportion properly the soda ash to the sulphate or hard scale content in the raw water and the success of any of them lies entirely in close supervision and a check not only to assure neither too little nor too much soda ash being used, but also to follow up the locomotive boiler operation in order that the boiler concentration may be held within workable limts to prevent loss and delay from foaming.

Some experimenting is being done with zeolite softening at the present time on the western coast. This system provides for running the raw water through a filtering medium which has an interchangeable base; that is, the filter absorbs the scale-forming elements and replaces them with non-scale-forming alkali salts. At specified periods the filter is regenerated by soaking in strong brine solution. The experience with this system in this section has shown it to give ideal service for laundries and similar industries but the excessive alkalinity produced with the resultant foaming and the high cost for pre-filtration and the salt regeneration have retarded its use for steam boiler service.

Lime-Soda Plants

The standard and complete method of complete water softening consists of the addition of lime and soda ash to the water in predetermined amounts at wayside settling tanks. Its object is not only to soften the water but also to remove the precipitated sludge with other mud or suspended matter, so as to deliver the water to the boilers not only soft, but clear. Common lime and soda ash are used for the reason that they are the lowest priced chemicals which can be obtained to do the work efficiently and economically. The types of plants vary not only with the patented proportioning equipment on the market, but also with the designs prepared to handle the local and individual conditions best. With proper attention and supervision, experience has shown that decidedly satisfactory results can be obtained in the way of scale and pitting elimination and that the economies effected usually far exceed the estimate.

There are two general types of lime and soda ash plants, called the intermittent, and the continuous. The intermittent type consists of one or more tanks which are filled with water, the chemicals then being added and the mixture stirred, after which, following a sedimentation period, the water is clear and ready for use. By manipulation of valves, the tanks can be used alternately for delivery to locomotives.

Plants of the continuous type consist of large tanks, usually of steel, with inside tubes of sufficient size to retain the water during the mixing period of from 30 to 45 min. The water and chemicals are mixed in these tubes in continuous proportion, flowing from the mixing tube to the bottom of the sedimentation tank from which they rise to a predetermined point before the clear water is drawn off for service. The specific gravity of the precipitated sudge is sufficiently greater than the water to permit complete clarification in five hours if the vertical velocity of the settling water does not exceed eight feet per hour. If clarification troubles are experienced, filters are sometimes provided which usually consist of matted excelsior at the top of the sedimentation tank, although there are a number of plants in service with rapid sand filters or pressure filters, either of the latter requiring transfer pumps which are unnecessary in the former case.

Offers Marked Savings

It seems needless to say that any of the various impurities in water will cause trouble contingent upon the amount and kind. Removal of such impurities is certain to show improved results, dependent upon the amount removed. The American Railway Engineering Association presented figures in 1914 to show that the cost of each pound of incrusting matter permitted to enter the locomotive boiler was seven cents, considering only the effect on fuel consumption, boiler and roundhouse repairs and engine time. This figure, transposed to present day prices, is 13 cents. Study by a special committee of the American Railway Engineering Association for the past four years has found that the statistics which have been gathered indicate that this figure is decidedly conservative. There is no question but that, with proper treatment of the water, scale and pitting conditions with their incident boiler maintenance expense, can be very largely eliminated and that the fuel consumption in clean and dry boilers is much less than with leaky or badly scaled power. In addition, the large intangible benefits, such as elimination of engine failures on the road and the reduction in delays to traffic and train movements, usually far outweigh the tangible savings in fuel consumption and boiler repairs.

The wide range of the problem of railway water treatment, including the design and installation of plants as well as the individual studies of the water quality and the check of actual treatment and its effect upon transportation and train movements, well warrant the special study which is being given to it on many roads. In the handling of this problem it is necessary to have the closest cooperation of the engineering, maintenance, motive power and operating departments to secure the best results. The best mechanical facilities will function only in a perfunctory manner or fail entirely if not followed up by a careful check system, and it has been found that an

organization with a definitely fixed responsibility is the first essential to successful results from railway water treatment.

Discussion

A. B. Scowden, (B. & O.) stated that following the completion of a number of water treating plants during the last three or four years a problem has arisen in the disposal of sludge at stations where it is impossible to discharge it into a stream. Settling basins have been tried but it has been difficult to get the sludge into a sufficiently solid condition to permit it to be handled.

C. R. Knowles, (I. C.) reported that while the disposal of sludge arises at all treating plants he has been able to solve this problem by constructing a settling basin in two compartments and discharging the sludge alternately into these compartments, pumping the water back into the treating plants after the sludge has settled and thereby recovering the water, the saving from which pays for the cost of the settling basin. By this means the sludge also solidifies sufficiently so that it can be handled readily. A further development has been made recently whereby the land development department has interested the farmers in the use of this sludge as fertilizer with the result that they take all of the sludge available at many plants.

In reply to a further question regarding removal of incrustation in pipe lines, Mr. Knowles pointed out that this condition arises largely from after-precipitation in pipe lines in certain types of treating plants, whereas it is present to only a very limited extent at other plants. While he has not found it necessary to clean any water mains at treating plants on the Illinois Central he has cleaned a number of pipe lines elsewhere, and this experience has shown him it is usually cheaper to lay new line than to clean lines of 2 in., 3 in. and 4 in. diameter, but that it is cheaper to clean larger lines.

The Use of Precast Concrete Units

THE COMMITTEE got in touch with engineers of each of the trunk line railways, asking for data on the precast units in use. Considerable data was thus secured and supplemented by information in the possession of the committee members. There follows a brief discussion of a number of precast concrete units.

Bridge Slabs

Precast bridge slabs are used to some extent by practically all of the larger roads. The one outstanding advantage is the minimum of interference with traffic during construction. The units, being of a safe age when placed, may be subjected to full loads immediately. On a road of two or more tracks, slabs for one track may be placed at a time, and even a single track structure may be placed in the intervals between trains. Ordinary pile trestle slabs are usually of from 14 to 18-ft. spans. For street crossings and other places where longer spans are required 30-ft. slabs are not extreme.

Precast bridge slabs may be constructed at a central plant, hauled to the site on flat cars and placed by crane, or they may be cast near the site in which case they may be put in place without being loaded on cars. Where a suitable crane is not readily available the slabs may be cast on falsework in such a position as to enable sliding them into place when cured.

The common practice is to use slabs of a width equal to one-half the distance between center lines of tracks. Where the span is short enough and placing equipment is heavy enough slabs of width equal to the track spacing have been used.

Sectional Abutments, Piers and Footings

Units for abutments, piers and footings are used to some extent, usually to replace, piece by piece, old timber structures as they decay. The work is done by the bridge and building forces and the units are best kept as small as possible to facilitate handling without calling for heavy equipment.

Probably the most common are small concrete piers or footings to replace wooden sills which are the first part of a timber bent to decay. In some cases these units are combined with precast concrete bulkhead slabs and bridge seats to form low abutments. Construction of this type is free from the fire hazard inherent in the common practice of using once-used timber to retain the fill.

Although foundation piles are sometimes cast in place precast piles are more commonly used. The length is limited only by facilities for handling. Sometimes they are equipped with jets for sinking but hammering is the usual method and the amount of driving a pile will take without damage is surprising.

The reinforcement usually consists of longitudinal bars and a spiral wrapping. Where the concrete is to be exposed to the weather the importance of anchoring the steel so as to insure a uniformly adequate covering of concrete cannot be emphasized too much. A high quality concrete is also essential.

Where a large number of piles are to be cast for a specific project it is well to prepare a few test piles to determine the length required. They can be cut if needed, however, and it is often the practice to cut away enough of the concrete to expose two or three feet of the reinforcing which is then bent over into the cap. A rope mat is commonly used to protect the top of the pile during driving. In some cases a special cap is used.

Railings

Even on cast in place bridges it is often convenient to use precast railings or at least precast facings for railings. There seems to be a tendency toward the use of light sections for bridge railings with the reinforcing steel insufficiently covered with concrete of a quality too poor to resist the action of the weather. This is doubtless due to the thought that the stresses on the units are small, which is true. But it ignores the fact that these light units are in an extremely exposed position and subjected to the most severe weathering.

In cases where an especially high class finish is required cut-cast units may be employed. These units are cast from specially selected aggregates and tooled. Very attractive effects are produced, often with a considerable saving over the cost of cut stone. In other cases it has been used at a higher cost because a better architectural effect was secured.

Pipe

The use of concrete culvert pipe is standard on practically all trunk line railroads. Some of the larger roads manufacture their own pipe. Others have done so but have abandoned the practice as there are a number of concrete products companies which are in position to furnish a high quality pipe.

Concrete pipe is available in sizes up to 84 in. although the smaller sizes are more numerous. Whether pipe is purchased or manufactured care should be taken to see

that a high quality concrete is used with sufficient reinforcing, securely anchored to insure correct spacing. For use under track, be sure the pipe is of railway weight and not a lighter weight pipe designed for highway structures.

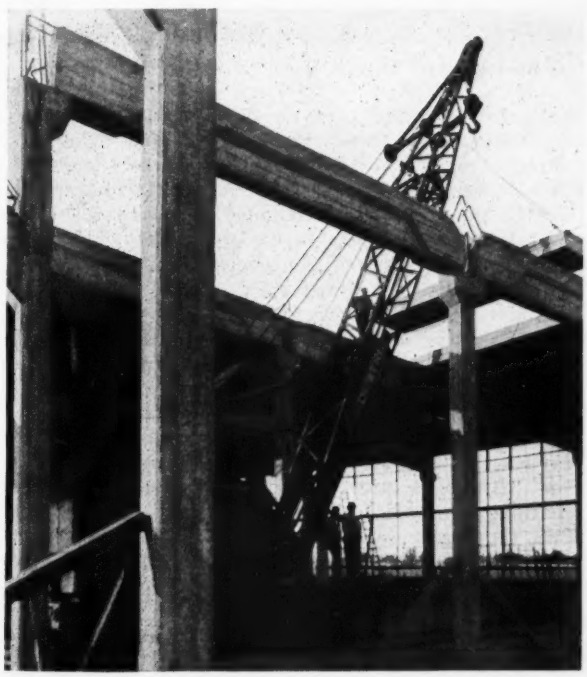
Because of the cost of first class forms it is economical only for those roads having large requirements to undertake the manufacture of pipe.

Buildings

Watchmen's shanties, telephone booths, small shelters at way stations, oil and tool houses, yard offices and structures to house electrical connections are a few of the buildings which may be cast as a unit and transported to the site ready for instant use. If well made, no maintenance is required other than of the doors and windows.

Buildings too large to be cast as a unit may be cast in sections and assembled. This practice has been followed in the construction of structures of considerable size. It seems especially advantageous in engine houses where there are a number of stalls all alike, requiring a number of units which may be cast in one set of forms.

Other than economy, the chief advantage of unit construction is the speed with which a building may be

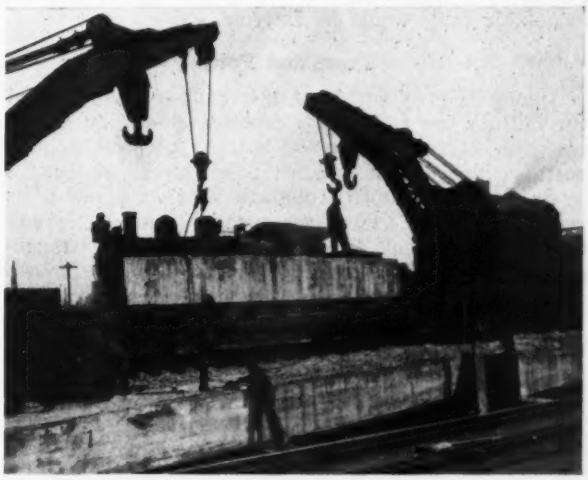


Erecting Precast Concrete Units in the Roundhouse of the Western Pacific at Stockton, Cal.

erected when everything is ready for the start. When the work must be done around a busy shop or terminal, this advantage becomes of utmost importance.

A somewhat similar construction has been used in tool houses and dwellings for maintenance of way employees. One type consists of verticals clamped together in such a way as to hold two thicknesses of slabs with a 3-in. air space between. Roads employing Mexican laborers report the use of structures of this type to prevent destruction of the building for firewood in cold weather.

Concrete blocks deserve more attention than they have received for structures of this type. One block occupies as much wall space as 13 brick. A check in 77 cities showed that an average number of 213.5 blocks, the equivalent of 2,775 brick, were laid in an 8-hour day compared with an average of 1,060 brick in the same period of time. The labor cost of laying up a given volume of block wall was therefore only 36 per cent of the cost for the same volume of brick wall. In addition, the block wall requires less mortar with a corresponding saving. For thin walls concrete blocks are considerably cheaper than a monolithic wall. Such walls rarely carry



Placing a Track Slab in the Ogden Avenue Subway of the Pennsylvania at Chicago.

much load and a little care in selecting the blocks, if they are purchased, will insure a good quality.

A less familiar use of concrete in a similar capacity is for trimstone or facestone. For this work the same sort of cut-cast stone mentioned for railings is used.

Retaining Walls

There are several types of concrete retaining walls made up of precast units. Probably the most common at present is the crib wall. The increased cost of ties and their short life when used as cribbing are eliminating them from consideration. Concrete units offer an excellent substitute.

There are several types of patented cribbing on the market with certain advantages claimed for each. All consist of stretchers and headers interlocked together. They require but little foundation and may be laid up rapidly. An advantage of a concrete crib wall is that it is both permanent and portable. When being placed on a new fill or unstable foundation its flexibility is an important advantage. The wall may be moved without the loss of any of the units. If no longer needed they may be stored until there is another opportunity to use them. The cost is said to be around 40 per cent to 60 per cent of the cost of a monolithic wall.

Among other advantages is the excellent drainage provided by the open face. Even those types designed to present a closed face permit drainage between units. It is easy to build a wall of medium height parallel and close to a track as one cell may be built at a time, the material for the backfill being obtained from the adjoining cell thus minimizing the handling of material. It is claimed that the cost of such a wall is less than a monolithic wall for heights less than 12 ft. Crib walls such as mentioned above are not often built to a height greater than 16 ft. although there are examples of such walls up to 24 ft. in height.

A third type of precast wall consists of concrete sheet

piles designed to interlock and in some cases to be tied back with steel rods. Such construction was used in the original Galveston causeway. Sheet piles of this character are made 10 to 12 in. in thickness, 20 to 36 in. in width and of the required lengths. They may be placed either by driving or with jets.

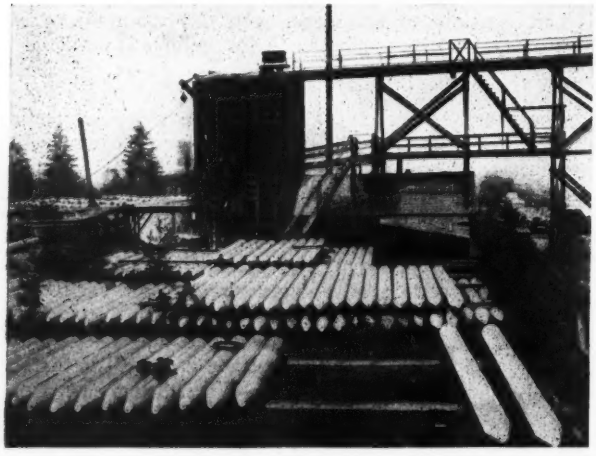
Another type of precast wall consists of large blocks which interlock together to form a gravity wall. Walls of this character may be used along water fronts where the cost of cofferdams to enable the construction of monolithic walls would be extreme.

Posts and Poles

Among the great variety of miscellaneous units adopted for railroad use fence posts probably stand first in importance. Increased cost and scarcity of good wooden posts, combined with freedom from danger of damage by fire has induced many companies to use concrete posts in great numbers. Posts are square, triangular, round or of irregular shape. There are many different arrangements for fastening wires. In some cases, what is known as the "Western Union" is used, a short piece of auxiliary wire around the post in the way a telegraph wire is fastened to an insulator. Sometimes one face of the post is corrugated to prevent the wire from slipping up or down where this method is used. Other companies cast holes in the post at intervals. One company provides an insert of special concrete in which ordinary staples may be driven.

Whistle, sign and mile posts of concrete are standard practice on several roads. They are inexpensive and durable. The lettering is recessed and painted.

Telegraph and telephone poles have been less extensively used on steam lines, but there are a few examples



The Concrete Products Plant of the Northern Pacific at Auburn, Wash.

all of which are favorable. Electric lines have used quite large numbers of them. The cost does not greatly exceed that of a treated wood pole.

Other Uses

Highway grade crossing slabs have been used with varying success. Concrete in such slabs is subjected to severe treatment and must be of high quality. The slabs must also be given some attention and maintenance. Under those circumstances a crossing that is exceptionally satisfactory to motorists results.

The signal department uses concrete in relatively small quantities and there are numerous advantages in having the work centralized. Practically all the units used may be precast. Battery wells, signal bases, cable posts, trunking bases and the trunking itself are some of the units more often used.

Water troughs for stock yards are standard on a number of railroads. The bases are cast separate from the trough. Concrete water barrels for fire protection might be considered strange but they are standard on at least two trunk line roads.

Concrete slabs for lining ore dock pockets were originally designed because it was thought they would last longer than wood and thereby reduce maintenance costs.

Concrete Water Barrels Used by the Northern Pacific.

That proved true but it has developed that the ore slides over it much more freely than over the wood lining.

Precast curbing is being used in many cases with considerable economy for small cinder platforms, around switch stands and water columns. Crossing manufacturers are recommending the use of concrete slabs under the ballast on heavy traffic crossings. As it is often difficult to arrange for casting such slabs in place precast slabs may be used to advantage. Even if some cracking does occur due to uneven bearing, the ballast will still be retained and the slab will serve its purpose.

Ties

Concrete ties are still in the experimental stage. There have been dozens of patents issued and many test installations. Although quite favorable reports are received regarding some of these tests it can hardly be said that a tie, thoroughly satisfactory from all standpoints, has been developed. As wood ties become scarce and more expensive the relative advantage of concrete ties will increase.

Other precast concrete units used by railways but not requiring special discussion in this report include, rail rests, manholes, roofing tile, chimneys, smoke jacks for engine houses, terrazzo and colored tile floor sections, roof slabs, decorative wall panels, car wheel racks, cattle guards, septic tanks and even flower pots for use around stations.

Products Plants

The plant should be designed to permit its operation with a minimum of handling of materials. On the other hand an investment in equipment greater than that justified by the amount of units to be made will result in high rental charges. The location of the plant is important. Considering material supply it would usually be economical to locate the plant at the site of a gravel plant served by the railroad. This might not fit in well with a scheme to use surplus bridge and building forces for operation during slack seasons as the gravel plant might not be so located as to make that possible. A plen-

tiful water supply must be available for mixing and for curing.

The equipment for a small plant need not be extensive. A good batch mixer of ample capacity so as not to give an incentive for reducing time of mixing is recommended. Unloading equipment and conveyors to put the aggregate in elevated bins are desirable if the size of the plant justifies the cost. The manufacture of heavy units requires some sort of a crane for handling. The same crane may be used to carry the mixed concrete to the forms.

Arrangement should be made for storage of enough aggregate to permit uninterrupted operation. Ample storage space should be served by cranes for transferring the units from the casting platform and to cars for shipment. The units should not be piled in the open, exposed to the sun and wind until they have been cured for at least 10 days with a plentiful supply of moisture. A 30-day curing period would be preferred. Otherwise the concrete will dry out rather than set up. Such concrete loses much in strength and ability to resist weathering. The units may be kept damp by sprinkling continuously or by periodical sprinkling combined with covering by sand, straw or canvas.

Few, if any, railway products plants will find it practical to undertake the manufacture of all the units enumerated above. At the start probably only one or two units should be tried. As the men become trained the plant may be extended to other units. Some require special equipment and special training and are not suited for manufacture in railroad products plants.

It would not be possible to specify proportions intelligently for use in different concrete products. The strength of concrete made with certain proportions varies with the gradation of the aggregate and the amount of mixing water used. The man in charge of a concrete products plant should thoroughly acquaint himself with these characteristics of aggregates and concrete. A mixture with the correct proportions of properly graded materials will work more easily and have higher strength for the same cement content.

Committee: T. H. Strate, engineer of track elevation, C. M. & St. P., chairman; J. S. Huntoon, assistant bridge engineer, M. C., vice-chairman; C. A. J. Richards, assistant engineer, Penna.; F. E. Taggart, assistant engineer, I. C.; H. R. Leonard, chief engineer, bridge and building, Penna.; W. F. Rech, bridge engineer, C. & A.; and L. M. Arms, engineer, Railways Bureau, Portland Cement Association.

Discussion

In the discussion of this report a number of members told of precast concrete units which they had built and placed. T. Turnbull, (Ann Arbor) suggested that a central plant at which precast units could be made would offer employment during the winter for men required for field concrete work in the summer. J. S. Huntoon, (M. C.) referred to the failure of concrete fence posts in many locations as indicating the necessity for the exercise of the greatest care to get concrete of high quality and to insure that reinforcement is properly placed, making necessary the employment of high-class workmen with adequate supervision In reply to a question regarding the repair of concrete after the reinforcement has become exposed J. S. Huntoon, (M. C.) stated that the use of sharp sand in a cement gun will enable the surface of exposed concrete to be cleaned effectively so that new concrete can be added. L. M. Arms, (Portland Cement Association) stated that this concrete may be added either by the use of a cement gun or by replacement by ordinary methods, although this requires expert workmanship. He also stated that some engineers consider the covering of exposed steel with a bituminous material to arrest corrosion a sufficient precaution.

Closing Business

AT THE closing session of the convention on Thursday forenoon the following officers were selected for the ensuing year: President, C. W. Wright, master carpenter, Long Island, Jamaica, N. Y.; first vice-president, E. T. Howson, editor, *Railway Engineering and Maintenance*, Chicago; second vice-president, F. C. Baluss, engineer bridges and buildings, Duluth, Missabe & Northern, Duluth, Minn.; third vice-president, Maro Johnson, assistant engineer, Illinois Central, Chicago; fourth vice-president, J. S. Huntoon, assistant bridge engineer, Michigan Central, Detroit, Mich. Directors: A. I. Gauthier, supervisor bridges and buildings, Boston & Maine, Concord, N. H.; E. L. Sinclair, assistant engineer, Chicago, Milwaukee & St. Paul, Marion, Iowa, and O. F. Dalstrom, bridge engineer, Chicago & North Western, Chicago. In addition C. S. Heritage, bridge engineer, Kansas City Southern, Kansas City, Mo.; W. D. Hotson, superintendent bridges and buildings, Elgin, Joliet & Eastern, Joilet, Ill., and P. N. Nelson supervisor of bridges and buildings, Southern Pacific, San Francisco, Cal., hold over as directors for another year.

The Executive committee has selected the following subjects for consideration and report at the next convention:

1. The use of motor cars by bridge and building gangs.
2. The use of creosoted timber, including the selection of woods best adapted to treatment.
3. The application of protective coatings to structural steel.
4. The relative merits of different kinds of roofing materials for various types of railroad buildings.
5. The use of compressed air on bridge and building work.
6. Methods of repairing disintegrated or poor concrete.
7. Pumping equipment for various kinds of service.
8. Protecting structures over tracks from locomotive gases.

Manufacturers Hold Largest Exhibit

FIFTY manufacturers of material and equipment for the construction and maintenance of bridges, buildings and water stations presented an exhibit of their products in a room adjoining the convention hall under the auspices of the Bridge and Building Supply Men's Association. This was a larger number of firms than was represented at any previous exhibit of this association. In general the exhibit consisted of literature and models, although steps were taken to make the exhibit more largely of the actual materials and equipment in succeeding years as a means of increasing its value.

The officers of the association during the past year were as follows: President, A. J. Filkins, Paul Dickinson, Inc., Chicago; vice-president, D. J. Higgins, American Valve & Meter Company, Chicago; treasurer, John E. Nelson, Joseph E. Nelson & Sons, Chicago; secretary, B. J. Wilson, The Pocket List of Railroad Officials, Chicago; honorary director, G. R. McVay, The Celotex Company, Chicago; members Executive committee: F. M. Condit, Fairbanks, Morse & Company, Chicago; H. C. Brown, Chicago Bridge & Iron Works, Montreal, Que.; W. D. Waugh, Detroit Graphite Company, St. Louis, Mo.; J. W. Shoop, The Lehon Company, Chicago; D. Hultgren, Massey Concrete Products Company, Chi-

cago, and O. T. Snow, T. W. Snow Construction Company, Chicago.

The companies which presented exhibits, together with the character of their exhibits and the names of their representatives follow:

List of Exhibitors

American Hoist & Derrick Co., St. Paul, Minn.; literature; W. L. Manson.

American Railway Hydrant & Valve Co., Stapleton, N. Y.; valves; W. Volkhardt.

American Valve & Meter Co., Cincinnati, Ohio; model of universal telescopic spout and water column; J. T. McGarry and D. J. Higgins.

Asbestos Shingle Slate Sheathing Co., Ambler, Pa.; asbestos shingles, asbestos corrugated sheathing, asbestos building lumber, partition board and ebonized asbestos lumber; I. B. Blain, G. E. Strebel and F. C. Weber.

Barber Asphalt Co., Philadelphia, Pa.; C. O. Dowell and G. D. Fowle.

Barrett Co., New York; literature; F. S. Nichols and B. S. Schmehl.

Beaver Products Co., Inc., Buffalo, N. Y.; roofing, wallboard, plaster; H. M. Butters.

Carter Bloxonend Flooring Co., Kansas City, Mo.; built up wood block flooring, literature and photographs; A. E. Giese and L. L. Bucklew.

Celotex Company, The, Chicago; photographs, literature and samples of wall board; G. R. McVay.

Chicago Bridge & Iron Works, Chicago; photographs and literature; E. P. Shelton.

Cleveland Pneumatic Tool Company, The, Cleveland, Ohio; hammers, riveters, wood and metal boring drills, rock drills and concrete breakers, air valves and hose couplings; B. H. Tripp.

Cook, Inc., A. D., Lawrenceburg, Ind.; deep well equipment; C. O'Brien and J. F. Freeman.

Detroit Graphite Company, Detroit, Mich.; literature; L. F. Flanagan, W. D. Waugh, A. B. Edge, J. R. C. Hintz, and J. F. Neiman.

Detroit Steel Products Company, Detroit, Mich.; R. S. Bishop and S. M. Hathaway.

Dickinson, Paul, Inc., Chicago; models of cast-iron camp car jack, ventilators and chimneys for small buildings; A. J. Filkins and C. Wm. Hansen.

Dixon, Joseph, Crucible Co., Jersey City, N. J.; graphite products; H. A. Nealley and J. C. Kemp.

Duff Mfg. Co., Pittsburgh, Pa.; jacks; E. A. Johnson and C. N. Thulin.

Fairbanks, Morse Co., Chicago; literature; F. M. Condit, B. S. Spaulding; E. C. Golladay, A. J. Olson, E. E. Pendray, H. E. Vogel, E. P. Chase and C. J. Fugitt.

Fairmont Railway Motors, Inc., Fairmont, Minn.; literature; W. D. Brooks and E. R. Mason.

Hastings Signal & Equipment Co., Boston, Mass.; automatic telltale hanger and replacer; B. J. Hastings, J. E. Freeling and H. H. Nayor.

Highgrade Mfg. Co., Cleveland, Ohio; literature and samples of roofing cement; S. A. Baber and J. N. Kinn.

Jones Paint Co., The Rome, N. Y.; A. D. Jones.

Jenkins Bros., New York City; valves, gage glasses, car heating gaskets; Charles B. Yardley.

Jennison-Wright Co., Toledo, Ohio; literature; T. B. Fogg and F. W. Cherrington.

Johns-Manville, Inc., New York; samples of roofing, pipe and boiler insulations, packing, shingles, corrugated siding and roofing, waterproofing and industrial flooring; P. C. Jacobs, W. H. Lawrence and R. P. Townsend.

Kaustine Company, Buffalo; literature; G. Carrington, Jr., Charles F. Smale and D. A. Evans.

Kentucky Rock Asphalt Co., Louisville, Ky.; samples of rock asphalt, photographs and literature; W. F. Pollard.

Lehon Company, The, Chicago; samples of roofing and shingles, waterproofing and roof coatings; Tom Lehon, J. W. Shoop, J. T. Carpenter and R. C. Chissom.

Lewis Asphalt Engineering Corp., New York City; samples of Karnak and Krodproof waterproofing and literature; Frank Russell.

Lowe Bros. Co., The, Dayton, Ohio; L. Ingraham.

Massey Concrete Products Corp., Chicago; literature, Charles Gilman, D. A. Hultgren, Paul Kircher and W. L. McDaniel.

Murdock Mfg. & Supply Co., Cincinnati, Ohio; hydrants, railway water service box and drinking fountains; J. C. Endebrock.

National Lead Company, New York; literature; Charles L. Haas, A. H. Sabin, W. S. Carlisle, F. E. Dodge and F. M. Hartley, Jr.

Nelson & Sons, Joseph E., Chicago; literature; John E. Nelson and William H. Nelson.

New Jersey Zinc Sales Co., New York; down spouts, gutters and roofing; R. G. Kenly.

Norton, A. O., Inc., Chicago; bridge jacks; R. J. McKay and H. W. Wilson.

Patterson & Co., W. W., Pittsburgh, Pa.; tackle blocks; W. W. Patterson, Jr.

Patterson Sargent Co., Cleveland, Ohio; L. J. McCombs and W. H. McBride.

Pocket List of Railroad Officials, New York City; publications, H. A. Brown and B. J. Wilson.

Railway Engineering and Maintenance, Chicago; copies of *Railway Engineering and Maintenance* and Railway Age; E. T. Howson, F. C. Koch, J. M. Rutherford and J. G. Little.

Railway Review, Chicago; copies of paper; George E. Boyd and W. H. Dickinson.

Redwood Mfg. Assn., San Francisco, Cal.; B. F. Wade.

Robertson & Co., Wm., Chicago; model of culvert; R. F. Repasz.

Sherwin-Williams Co., Cleveland, Ohio; literature and samples of paint; S. R. Fraser.

Sipe & Co., James B., Pittsburgh, Pa.; D. B. Vail and R. M. Smith.

Snow Construction Co., T. W., Chicago; literature; V. L. Walker.

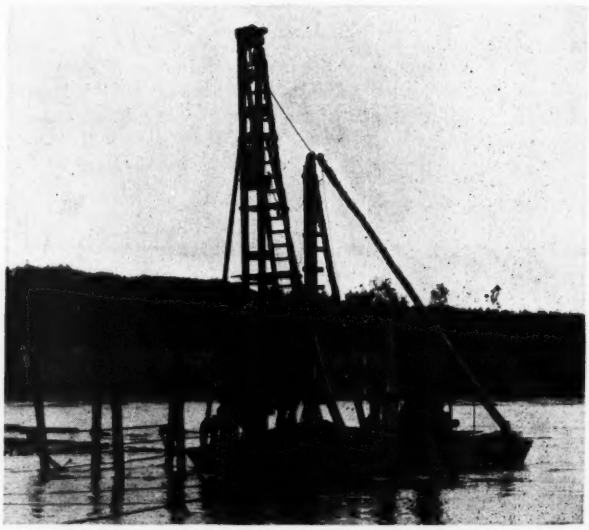
Templeton-Kenly Co., Ltd., Chicago; bridge jacks up to 15 and 25 ton capacity; G. L. Mayer and A. C. Lewis.

U. S. Wind Engine & Pump Co., Batavia, Ill.; literature; C. E. Ward.

Woolery Machine Company, Minneapolis, Minn.; literature; J. T. Stephenson.

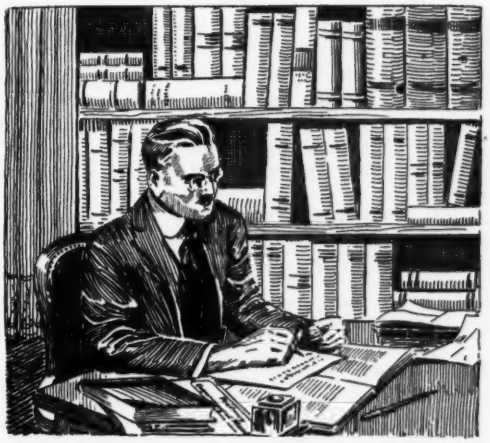
Zitterell Co., W. J., Webster City, Iowa; photographs; G. C. Mills.

At the annual meeting held on Thursday morning the following officers were selected for the ensuing year; President, D. J. Higgins, American Valve & Meter Co., Chicago; vice-president, John E. Nelson, Joseph E. Nelson & Sons, Chicago; treasurer, B. J. Wilson, The Pocket List of Railroad Officials, Chicago; secretary, F. M. Condit, Fairbanks, Morse & Co., Chicago; members of executive committee: W. D. Waugh, Detroit Graphite Company, St. Louis, Mo.; J. W. Shoop, The Lehon Company, Chicago; D. Hultgren, Massey Concrete Products Company, Chicago; O. T. Snow, T. W. Snow Construction Company, Chicago; R. F. Repasz, William Robertson & Co., Chicago, and D. Evans, Kaustine Company, Reading, Pa.



Driving Piles From a Scow in a Swift Current Calls for Skilfull Work

What's the Answer?



This department is designed to serve as a reader's service bureau, wherein the many problems which arise in the routine maintenance of tracks, bridges, buildings and water service facilities, may be subjected to frank and thorough discussion. The value of the service thus rendered is proportionate to the extent to which readers avail themselves of it, in submitting questions and in lending their co-operation by offering answers to the questions presented.

Questions to be Answered in the January Issue

1. Should a track foreman be permitted to shim track on the end of a bridge to adjust for heaving or should he put out a slow order until a bridge gang can do this work?

2. What stock should be carried by a water service organization on a division of 500 miles to insure prompt emergency repairs?

3. Is it good practice to tamp only one side of a tie in rock ballast or should both sides be tamped?

4. When a wooden trestle is being replaced by a culvert or concrete bridge requires some alterations to clear portions of the new structure, should these changes be made by the concrete gang (company force) or should this be done by a bridge carpenter gang?

5. What type of snow shovel as regards blade and length of handle is preferable for flanging track?

6. Does the increased facility in changing switch points by having all the bolts entering the heel blocks from the outside justify the sacrifice of safety afforded by staggered bolting?

7. Should a motor car operating on one track of a double track line be stopped before meeting a train moving on the opposite track?

8. Should the floor of a passenger station be flush with the platform or raised one step above the platform?

Should the Joists Be Creosoted?

In building a small passenger station of high grade construction is the use of creosoted timber for the sills and joists supporting the floor where no basement is provided justified to insure a long life for the floor construction?

Use Treated Wood Wherever It Comes in Contact with Soil

By E. A. Harrison
Architect, Atchison, Topeka & Santa Fe System, Chicago

In our better class of buildings, such as a combination freight and passenger station, the floors and foundations are of concrete. The elevated platforms 3½ ft. above grade are supported on creosoted pile heads which are the ends left when piles are sawed off.

In our standard frame stations, which are usually built on new lines, the building is supported on creosoted posts and sills, in fact, treated material is used in all places where earth comes in contact with framing. At a point where a platform at grade comes against a building we support it on a 2-in. by 12-in. creosoted plank while at the outer edge of the platform next to the track we use a 3-in. by 10-in. creosoted sill bolted to small pile butts or split sections of the same material.

[The use of treated timber in damp or poorly ventilated locations or where the timber is necessarily close to or in contact with soil represents a tendency in building construction that is in line with established practice in bridge work. It comprises a more direct and positive solution of the problem of decay in floor joists and flooring, which builders have long endeavored to meet solely by measures designed to insure effective ventilation. W. T. Krausch, engineer of buildings of the Chicago, Burlington & Quincy, reports that the use of creosoted material in such situations prevents checking and splitting and decay and consequently enables the timbers to retain their original strength.—Editor.]

Which Tools Should Be Used?

Under what conditions should (a) tamping bars, (b) tamping picks, and (c) track shovels be used for tamping ties?

Each Tamping Tool Has Its Place

By J. B. Martin
General Inspector of Track, New York Central, Cleveland, Ohio

My answer to this question can be stated in the form of several recommendations.

Use tamping bars for light surface lifts on stone, gravel or cinder ballast, also for spot surfacing or picking up. Use tamping picks for tamping stone ballast under crossing frogs and for tamping joints when spot-surfacing stone ballasted tracks. Picks are advocated and used extensively for tamping stone ballasted tracks where surface lifts are made but I believe that

bars are preferable as the tamping will be solid enough to hold and greater progress can be made.

Used shovels for tamping gravel or cinder ballasted track when the lift is two inches or more. Effective tamping can be done with a track shovel at this height. On stone or slag ballast such raises can be tamped with spades or forks.

Do Not Depend Too Much on the Shovel

By J. B. Kelly
General Roadmaster, Minneapolis, St. Paul & Sault Ste. Marie, Minneapolis, Minn.

Tamping bars are indispensable as a means of securing properly spotted and surfaced track in most kinds of ballast from coarse sand to ordinary stone inclusive. The bar does not exact so much energy from the skillful worker as other tools and is sometimes known to be a means of promoting satisfactory working conditions. By the use of the spear-top tamping bar, coarse gravel and stone may be worked to the complete tamping of every tie without the necessity of shovel work and in my opinion it is the most efficient device other than the pneumatic or electric tampers.

In the finer gravel, running to about 75 per cent sand, the tamping bar should be used to follow shovel tamping at joints and its use should also be insisted upon even in mixed or dirty ballast. There seems to be no other way of supporting the track properly for the policy of putting joints up ¼ in. high to dispense with the use of the bar is not only bad for track fastenings but invites lossening of the track from the bed.

I do not favor the tamping pick because the tamping bar is just as effective and a great deal faster. The pick exacts a great deal more energy in man power to attain the same results.

Track shovels should be used in the tamping of ties on high or preliminary lifts in most kinds of ballast and as a general tool in the final tamping of the lighter mixed ballasts, but should be followed with the tamping bar to get a solid bearing directly under the rail at joints where it is not possible to get results with the shovel.

Wrecked Masonry as an Obstacle to Trestle Construction

In a case where a masonry structure has been destroyed by a flood and submerged stone or concrete interferes with the driving of piles for the temporary trestle required to restore traffic, what is the most practical method of blasting out the masonry so that the pile driving can proceed?

Better Built a "Shoo-Fly"

By I. L. Simmons
Bridge Engineer, Chicago, Rock Island & Pacific, Chicago

If I had a condition of that kind to meet I should not concern myself with the removal of the old masonry at all until after traffic was restored. Usually the question of restoring traffic is of such prime importance that one does not have time to clear the channel of the old structure, and a run-around is built for temporary use. After traffic is restored, plans are then made for rebulding the structure, and the question of removing the old masonry is one that is handled in connection with the construction of the new bridge. A cofferdam is usually built around the old pier or abutment and such portions of it as interfere with the construction of the new bridge is taken out inside of the cofferdam.

To answer the question directly as to the best method of dynamiting or blasting out the old masonry should such a course be decided upon, I should say that the first thing to be considered is the drilling of holes so that the charge can be placed. This is usually done with a jack hammer and if the water is deep and the old masonry is covered with sand, a pipe is sunk so as to guide the drill and assist in placing the charge of dynamite or other explosive. The charge is then placed in the hole, a waterproof fuse is attached and a battery used to explode the charge.

This is rather a long process and I doubt very much if the management of any railroad would permit one to consume so much time in restoring traffic.

It Should Not Be Necessary

By G. W. Rear
Engineer of Bridges, Southern Pacific, San Francisco, Cal.

No definite answer can be given to so general a question. Conditions vary so much as to the size and position of the submerged structure that each case is a problem in itself.

It is preferable to space the bents so that they will stradle the masonry even if this calls for longer spans than are ordinarily used and if necessary, bents can be placed on the submerged masonry and used temporarily. We have had several masonry structures destroyed, but have not found it necessary to blast out any of the masonry to clear the temporary structures.

How Much Supervision Should a Foreman Have?

How frequently should a roadmaster go over his various sections with the foreman on foot or motor car?

At Least Once Every Six Months

By W. T. Pace
Roadmaster, Atlantic Coast Line, Live Oak, Fla.

I think that a roadmaster should go over his main line sections in company with the foreman on a motor car not less than once each six months. In yard sections it is my opinion that a a visit once a month is necessary. In going over the yard sections the trip should be made on foot as that is the only way that the proper inspection and supervision can be given.

It has been my experience that if I go over a foreman's section with him and look into each defect and study the work it has been planned to do, much better results can be obtained than if I write him or even tell him about certain things on his section that are needed. The results will be even more certain if he knows that I will soon make another personal inspection with him.

Twice a Month is the Mark to Shoot At

By J. Sweeney
Supervisor, Chicago & Eastern Illinois, Danville, Ill.

I believe there can be no set rule regarding the frequency with which a roadmaster should go over his various sections with the foreman on foot or motor car because local conditions, such as train schedules and weather conditions, etc., govern the movement of a roadmaster over his territory. Assuming that a

roadmaster is following out his regular schedule as outlined by the division engineer, it might be impossible to make frequent personal visits to all his foremen each month. However, I make it a practice to see each of my section foremen at least twice a month in some manner or other. It is, of course, most satisfactory to go over the sections on foot because only in that way is it possible to get the best understanding of what progress is being made and to see that the foremen maintain a good gang organization. However, as it is necessary on some occasions for the supervisor to direct certain jobs personally it is difficult for him to go over the track conditions on foot with all the foremen twice a month. When the time is not available for this it is advisable to use a motor car, traveling at such a speed as to derive the most benefit from these inspections and stopping the motor car at all points of importance.

Three Trips a Year Are Sufficient

By F. J. Meyer
Assistant Engineer, New York, Ontario & Western, Middletown, N. Y.

As a general proposition three trips a year over each section with the section foreman should be sufficient—one trip in the spring for the purpose of planning the year's work, one trip to make the ties for renewal, and one trip late in the fall for a detailed inspection and inventory, and to estimate the material required for the following year.

More frequent trips with the foreman take him away from the gang and take valuable time of the roadmaster, which might better be used to coach the less experienced men to speed up and standardize the work in progress on the various sections.

Semi-Monthly on Motor Car, Bi-Monthly on Foot

By C. L. Elliott
Roadmaster, Forth Worth & Rio Grande, Brownwood, Tex.

A roadmaster should go over his entire division on a motor car at least twice each month or more often if necessary to follow up the work he has outlined or which must have his personal supervision. A roadmaster should walk over the track on the entire division at least once every two months. He will find small defects, such as wide gage, a broken joint, or a defect in the rail that he will not find on a motor car trip. He will also have a better understanding of the tie conditions. He should point out to the foremen those defects which he has noticed and make necessary arrangements for repairs without delay.

Protecting Coaling Stations from Fire

What provision should be made for the prevention and fighting of fires in coaling stations?

An Outline of the Requirements

By F. R. Judd
Engineer of Buildings, Illinois Central, Chicago

The protection of a coaling station from fire must be considered under several different heads (1) the character of construction to be adopted in a new station, (2) provisions to prevent fires in an existing station, and (3) facilities for fighting fires.

The provisions for fire prevention to be considered when contemplating the construction of coal chutes are as follows:

(1) Construct coal chutes of concrete with fire proof roofs and with door and window openings provided with wire glass.
(2) Equip the electric lighting fixtures with vapor proof globes and place all wiring in conduits.
(3) Enclose all motors entirely or provide fire extinguishers near the motors.
(4) Design the chute and machinery so as to keep the coal breakage at a minimum.

The provisions for preventing fire in existing coal chutes are as follows:

(1) Enclose motors or provide fire extinguishers near them.
(2) Collect and remove coal dust at regular intervals.
(3) Prevent water or moisture from reaching the coal.
(4) Remove birds' nests or other foreign inflammable material.

To fight fires in existing coal chutes of timber construction provide an automatic sprinkler system and fire hydrants with hose if water is available. If not, install a chemical fire engine of sufficient size and properly equipped to meet the conditions. In a concrete or steel chute provide a chemical fire engine equipped with hose to suit conditions.

Good Design is the First Requisite

By J. G. Forster
Vice-President, Ogle Construction Company, Chicago

In coaling stations, as in other buildings, the best safeguard against extraneous fire hazards is fireproof construction. Where the cost of fireproof construction is not justifiable and timber is used, the entire structure should be built of heavy slow-burning timbers and should be designed with as few flat or horizontal exterior projections as possible. In such structures it is prudent to line the storage bin with sheet steel or concrete slabs and, if practical, to install a sprinkler system. Irrespective of the type of construction, it is always desirable to install a vent in the top of the coaling station bin, since coal dust and, at times, combustable gases accumulate and means should be provided for their dissipation.

A great many coaling station fires start in the storage bin, and while fireproof construction and the other expedients previously mentioned reduce structural damage, they do not prevent the loss of the fuel stored in the bin nor do they eliminate the impairment to coaling station service or the other delays and damages which result from such fires. Accumulation of slack coal is the principal cause of fire originating in the storage bin. Therefore, any feature of coaling station design, construction or equipment which tends to prevent the accumulation of slack coal obviously reduces this internal fire hazard.

Slack coal accumulates (1) if it is permitted to separate from the lump coal when it is discharged into the storage bin; (2) if the bin is so designed that only part of the coal in the bin moves when deliveries are made to the locomotive; (3) if the bin is not cleaned at regular intervals; (4) if the delivery fixture is of a type which permits the firemen or hostlers to skim the coal, that is, to open the delivery gate so that only lump coal flows through the gate opening to the tender.

A coal storage bin, if designed and constructed as follows, will minimize the accumulation of slack coal and consequently reduce the fire hazard resulting therefrom:

(1) Construct a dumping baffle in front of the discharge end of the inlet chute. Without such a baffle the lump coal obtains greater momentum than the slack in sliding down the inlet chute with the result that the lump coal will fall towards the

front of the bin and the slack coal will drop almost vertically from the inlet chute to the bin floor. By placing the baffle as suggested the coals as it slides off the inlet chute strikes it and a good mixture of lump and slack is deflected vertically downward to the ridge of the bin floor.

(2) Construct the floor of the bin so that when coal is taken from an outlet all of the coal in that section of the bin which supplies that outlet, will move. This can be accomplished by hoppering all sides of the bin floor towards the outlet, thus giving it the shape of an inverted cone or pyramid.

(3) Partition the storage pocket. This does not acually reduce the accumulation of slack, but it permits cleaning the bin frequently without imparing coaling service. A number of fires can be attributed to the fact that the storage pocket had not been cleaned for months because of the urgency of service. By partitioning the bin one section can be kept in service while the other is being cleaned.

(4) Install delivery fixtures which are so designed that slack coal is released as soon as the gate is opened and that in order to obtain lump coal the fireman or hostlers are compelled to open the delivery gate its full width.

Reducing Hours Rather Than the Force

To what extent is it desirable and practicable to work all members of section gangs part time during the winter in lieu of laying part of the men off?

Give First Consideration to the Regular Men

By O. Sukprenant
Roadmaster, Delaware & Hudson, Schenectady, N. Y.

This question should be studied with a view of insuring justice to both the company and to the regular track men. In order to attain this end, a limited number of regular men should be allotted to each section. This will require the employment of extra men (to be hired locally, if possible) to fill out section gang when necessary during the busy seasons. When forces are cut the extra men should be laid off first, allowing the regular men to remain at work. Should it become necessary to make further reductions all regular section gangs should be employed on part time, for example, working even sections today and odd sections tomorrow. It is important to insure good treatment of the regular section gangs as they are a part of the company organization. As local conditions vary on the railroads it will be necessary to vary this plan in applying it. Extra gangs should also be dealt with in the same manner.

There are Several Objections to the Part Time Plan

By Roadmaster

It is generally conceded that the cutting of the forces in the fall leads to unfortunate results, the reasons for which are well known and need not be discussed here. But any plan for reducing the labor expenditure by cutting the time for the men rather than using the number employed should be considered with extreme care before any steps are taken to put it into actual practice.

In the first place the plan must be one which will be fair to the senior men. With the flat wage rate, greater security of position is about the only distinct recognition that can be offered the faithful trackmen of long service which will give him any advantage over the man who has been employed but a short time. That the senior man should be given preferred recognition is a principle of long standing. It is not only recognized by employers but the employees themselves, as a rule, consider that it is no more than justice. In train service, for example, a reduction in the amount of work beyond a certain limit is followed by a sufficient reduction in the force to insure fair earnings to those who are retained.

Therefore, in planning any reduction in the hour's worked, thorough consideration must be given to the interests of the employee long in the service. It is also necessary to determine carefully what reduction in working time can be made and still afford average monthly earnings which will insure against discontentment on the part of those retained. In my opinion the plan for shortening the hours is not a practical one.

(B. E. Elliott, roadmaster, Fort Worth & Rio Grande, objects to the plan for reducing the hours because he fears that part-time employment of the gang will leave the track unprotected. This objection may be overcome, however, by arranging to have the men in the gang take their time off on different days so that at least a part of the gang would be on duty each day. D. T. McKee, section foreman, Logan, Ohio, favors part-time service of a greater number of men because it makes a larger force available for emergency work than is the case if the reduction in labor allotment is made entirely by cutting the force. The plan of reducing the hours worked rather than the number of men has been followed with entire success on the Detroit, Toledo & Ironton.—Editor.)

Insuring the Free Movement of Switch Rails

Is it better to bend the inside splice bars at the heel of a switch to provide for free movement of the switch rails, or to plane off the bars to accomplish this object?

It Is Better to Bend the Bars

By W. P. Wiltsee
Chief Engineer, Norfolk & Western, Roanoke, Va.

In my opinion it is better to bend the splice bars, for the reason that it is more easily done and consequently less expensive; whereas planing the bar will cost more and weaken it to some extent.

Thimbles Make Both Planing and Bending Unnecessary

By A. J. Neafie
Principal Assistant Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

We do not plane or bend splice bars at the heels of switches unless the switch points are less than 15 ft. in length. However, at interlocking plants we provide thimbles and special bars at the heels of switches. This provides free movement of the switch rails without bending or planing the bars.

Prefers the Use of Thimbles

By C. L. Elliott
Roadmaster, Ft. Worth & Rio Grande, Brownswood, Tex.

I do not believe that it is a good idea to bend the bars at heels of switch points to allow for the free movement of the switch. Neither do I think it is practicable to plane off the bars to obtain the desired clearance. A good method of meeting a situation of this kind is to use a thimble on the heel joint bolt which is nearest to the point. The hole in the switch rail should be large enough to allow the thimble to slip over the bolt and through this hole so that it comes in contact with the filler block. The thimble

should be just long enough to allow ⅛-in of play when the nut has been drawn up so as to bring the angle bar tight up against the thimble. The other three bolts in the joint are drawn up tight to give a solid joint. This arrangement is standard on the St. Louis-San Francisco and has proved successful.

Should Railroad Pumping Equipment Be Standardized?

To what extent is the standardization of pumping units practical or desirable?

It Would Effect Marked Economies

By J. N. Woodell

Supervisor of Water Supply, Atlantic Coast Line, Jacksonville, Fla.

I think that more consideration should be given to standardization of pumping units in water supply service on the railroads. A study of water service on almost any railroad will almost invariably show that pumping units of all types, sizes and kinds are in use, some of them long since out of date and very uneconomical from an operating standpoint.

Recently the tendency seems to be toward electric-driven, automatic-control pumping units where dependable power can be secured. However, even in even in these cases it seems that little regard is paid to the standardization of the various units.

It is my opinion that a method of standardization could be worked out and that two sizes of pumping units could be adopted that would answer all requirements for the average water station in railway water service. It might be necessary in some particular cases to deviate from the two standards but this would be rare.

The standardization of pumping units would be a big help in making repairs and in keeping a stock of repair parts on hand. It would also enable the repair gangs to make repairs in a much shorter time than is now done owing to the inability to secure repair parts for obsolete pumping units. I believe that the work of standardization should be carried as far as possible and that even the pipe lines and fittings should be standard and interchangeable as far as practical in all pumping stations.

Standardize the Details

By Water Service Engineer

From the standpoint of economy in maintenance there can be no question as to the advantage of complete standardization of equipment in pumping stations. If all pumps were of the same size and make, were operated by the same size and make of power unit, with all valves, piping layouts and other appurtenance exactly alike, the problem of repairs would be greatly simplified. But this represents an ideal situation which cannot be obtained and is not desirable because the advantages from the standpoint of maintenance would be offset by certain disadvantages.

The foremost question, that of the wisdom of limiting purchases to a single make of equipment, has arguments on both sides which are identical with those which arise when this question comes up concerning any manufactured equipment used on the railroads. These arguments are well known and need not be discussed here. The next question concerns the type of pumping equipment, and the answer is that one type will not serve all purposes. What may be appropriate for a deep well supply will not serve the purpose where the water is taken from a lake, reservoir or stream and vice versa.

There is considerable merit in the plea for a reduction in the number of different sizes of pumps; however, it is well to bear in mind that although there is an advantage from the maintenance standpoint in using a pump larger than that required by the demand, as would often be the case if fewer sizes were bought, the purchase of over-size units would entail greater first costs. But the problem is still more complex as regards power units, since a power unit in most cases is operating at its greatest efficiency only when used at its normal rated capacity. This would not be the case if larger units were installed to avoid the purchase of a unit smaller than the established standard. Furthermore, it would not be practicable to adopt one size of power unit for each size of pump because the horsepower required depends not alone on the required pumping capacity but also on the head under which the pump is operating, a matter which becomes particularly critical in connection with centrifugal pumps.

There are, however, opportunities for standardization in what might be termed the incidental equipment such as the pipe and pump valves, gaskets, etc., since a reduction in the number of styles and sizes would greatly simplify the repair man's problem and it would also effect a marked reduction in the stock of such parts which must be carried.

Provide Only Two Sizes of Pumps

By W. T. Pace

Roadmaster, Atlantic Coast Line, Live Oak, Fla.

I am a firm believer in the standardization of pumping units in railway water supply and think that this should be carried just as far as it is practicable to do so. Of course, the physical conditions at each place have to be given consideration but it has been my experience that in 90 per cent of the pumping plants, two sizes of standard equipment could be used. Thus, for any intermediate station where the water supply is secured from a well or stream where the total head is not over 100 ft., and the total demand is not in excess of say 100,000 gal. per day, I suggest the following standard units.

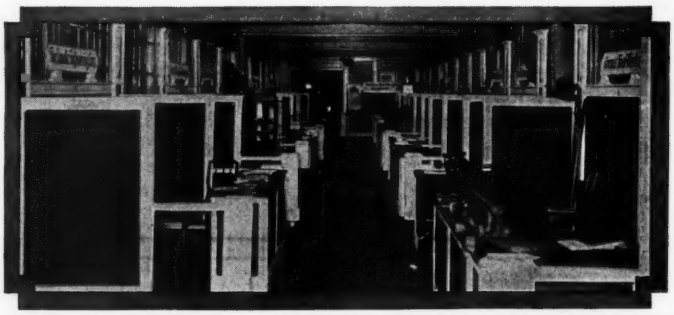
Electric driven (automatic control).—A 10-hp. electric motor direct connected to a split casing, double-suction, centrifugal pump of 300 gal. per min. capacity with a 4-in. suction and a 3-in. discharge. Each pump and motor should be the same and all parts interchangeable.

Oil engine driven.—A 10-hp. oil engine with a centrifugal pump of the same type as for electric-driven outfits if possible. This can be direct connected to the engine or be driven through a belt drive. I prefer the belt drive as it is fool proof. If desired, a plunger pump may be used with the oil engine in place of the centrifugal pump.

Steam driven outfits.—A 20-hp. boiler with any standard make of double-stroke steam pump. This should be an 8-in. by 7-in. by 12-in. pump with inside-packed pistons, a 6 in. suction and a 5 in. or 6 in. discharge.

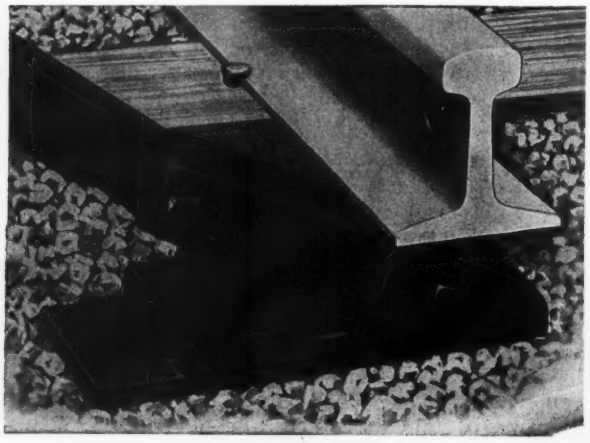
In the larger pumping plants around terminals or where a large amount of water is used a larger unit of the same types as the above should be used and in most cases a 25-hp. motor or oil engine or a 40-hp. steam boiler with a pump of corresponding size can be used. Of course there will be a few stations on each division where the physical layout makes it impossible or impractical to use the standard units. However, in a great many of these, some portions of the standard units can be used, that is, one of the standard pumps or motors, etc.

New and Improved Devices



A Track Liner With a Smooth Base

A TRACK liner manufactured by the Buda Company, Chicago, and known as the Buda-Clark liner, embodies a distinctive idea in that the base has no projections on the lower side to grip the ballast and it is operated in a manner that differs from the ordinary application of devices of this kind. It consists of a single lever with a socket to receive a lining bar that is attached to the base in two ways. The bottom of the lever is connected by a pin with a sliding shoe which moves



The Buda-Clark Track Liner

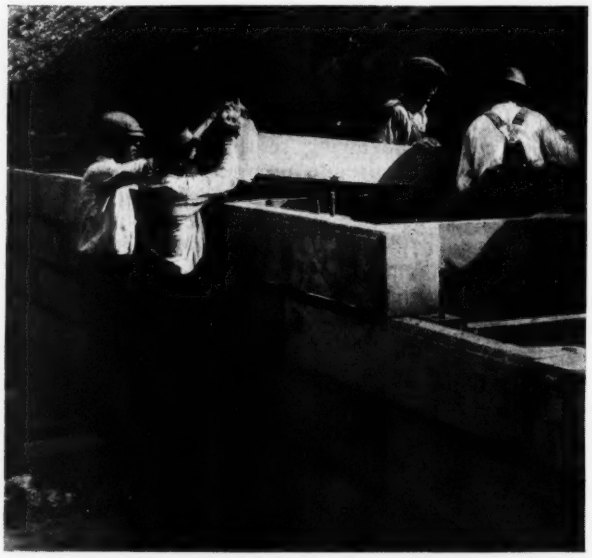
in a pair of guides projecting from the top of the base near its rear end, while attached to the bar a short distance above the lower end by means of a pin are two links which connect by means of a second pin to a rib at the forward end of the base. To operate this liner the forward end is pushed under the rail until the edge of the rail comes opposite an arrow marked on the sides of the links. Then as the lever is raised the shoe at the foot of the lever slides backwards in the guides while the two links swing upward about the forward pin connection and exert a pressure against the edge of the rail to throw the track over.

As seen in the photograph, the forward end of the liner has a pointed nose so that it requires almost no clearance between the ballast and the rail to permit the base to be pushed forward under the rail. For this reason it is rarely necessary to dig away any ballast to place the liner in position. The liner is operated by a pumping action on the bar, combined with a forward shove on the bar every time it is lowered for a new pull. Since the base is smooth on the lower side this action causes the base to move forward just before making the upward stroke of the lever, or in other words, the liner is made to follow the rail as the track is thrown.

The manufacturer calls attention to the fact that this device introduces no obstruction to traffic since it requires merely a lowering of the lever to keep the device entirely clear of trains. The base and the socket lever are made of malleable iron, while the two links that come in contact with the rail are of manganese steel. The entire weight is 35 pounds. It is said that this device can be used in all kinds of ballast and that it can be used for lining frogs and switches as well as standard track. Three men with two liners are ordinarily used in throwing track in ordinary gravel ballast while four men with two liners can line track in average stone ballasted track.

New Concrete Cribbing Makes a Solid Face Wall

A RECENT development in concrete cribbing units for use in the construction of retaining walls is essentially unique in that the new units make a wall having the appearance of ashlar masonry. There are but two members; a face member or stretcher and an anchor member or header, the design being such that the headers



The Units Can Be Readily Erected by Hand

are not exposed on the face of the wall, but are securely attached to the rear of the stretchers by an ingenious arrangement of connecting lugs.

The stretchers are 6 ft. long, 12 in. high and 4½ in. thick. They are equipped at each end with an anchor lug projecting 6 in. to the rear for effecting a connection with the headers. The headers are Y-shaped members having a stem and legs 8 in. by 4 in. in section and an enlarged base or anchor detail fitted with two ¾-in. round bars which project 4 in. from the top and

bottom. These bars or dowels fit into holes provided in the corresponding anchor lugs of the adjacent stretchers.

In laying the wall the joints in alternate rows of stretchers are staggered or broken as in ashlar masonry, while the headers are placed with their bases resting on top of the anchor lugs at each joint. Thus the header is connected to the adjacent stretchers of alternate courses, while the end of each header rests behind the middle of the stretcher in the intermediate course. Furthermore, the spread legs at the rear of the headers provide the anchorage for the structure as a whole and are arranged so that the ends of the legs of one course rests on the ends of the legs of the course next below. Through this arrangment the headers are afforded the necessary support at the rear and the introduction of a row of stretchers is unnecessary.

The Y-Shaped Headers Make Rear Stretchers Unnecessary

From this it will be seen that the wall forms a stable, interlocked construction. The Federal Cement Tile Company, Chicago, the manufacturer, claims for these new cribbing units a wide range of adaptability to a variety of structural applications without recourse to makeshifts, regardless of the conditions to be met.

Increasing the Workability of Concrete

CORRECT proportioning of concrete is closely related to "workability" which may be described as the property which keeps the mass, when once started, moving as a unit and enables it to flow freely against the forms and around the reinforcement. It is well known that concrete made from the finer gradations of aggregate is more workable than that containing coarser ones. As the cement content is increased the workability is likewise increased in greater proportion than by similar additions of fine sand. It has been contended, therefore, that if a material finer than cement is used a still greater increase in workability would be obtained.

This thought led to the experiments with the use of diatomaceous earth (Celite) as an ingredient in concrete for the purpose of increasing its workability. It is much finer than either cement or hydrated lime. Thus on a fineness scale with Celite at 100, hydrated lime is 59 and Portland cement is about 29. Celite is practically pure silica and therefore a distinctly inert material.

Tests of concrete in which this material has been introduced as an added ingredient indicate a marked increase in the workability. It is said that such concrete flows more readily with less labor in handling or manipulation and that the voids are smaller than in concrete made in exactly the same proportions of the same ingredients except that the Celite has been left out. The manufacturers also call attention to the advantages of the presence of the fine inert material in the concrete as an added protection against the action of sulphate in sea water or gas from locomotives. Diatomaceous earth has been used extensively abroad as a means of furnishing finely divided silica to cement mixtures.

The theory accepted by some authorities is that this finely divided form of silica is available to combine with the free lime, set forth through hydration of the cement, to form an insoluble compound of cementitious value. That this action takes place is indicated by tests made by the North Carolina State Highway Commission. Tests were made of over 2,000 specimens containing Celite. The tests at the age of one year indicated an increase in relative strength of from 2 to 15 per cent greater than that of plain concrete.

The physical characteristics of Celite are indicated by specifications for diatomaceous earth for use in concrete suggested by the manufacturers of Celite, the Celite Products Company, Chicago.

Diatomaceous earth for use in concrete or hydraulic cement compositions shall be finely divided Plankton Marine diatomaceous earth free from clay and crystaline silica and shall conform to the following requirements:

Not more than 1 per cent by weight of the material shall be retained on a 30-mesh screen.

Not more than 15 per cent by weight of the material shall be retained on a 200-mesh screen.

Celite Was Used in the Concrete for the Illinois Central Suburban Station at Chicago

Settling tests with distilled water shall show not less than 55 per cent of the material remaining in suspension after 20 min.; and after five hours settling tests shall show not more than 28 per cent, nor less than 16 per cent remaining in suspension.

The material shall not contain more than 10 per cent by weight of moisture.

A moisture free sample of the material shall not show a loss on ignition at 1800 deg. F. of more than 60 per cent. An ignited sample shall contain at least 92 per cent of silica and not over 4 per cent of alumina.

With the Associations

Maintenance of Way Club of Chicago

The annual meeting and dinner of the Maintenance of Way Club of Chicago was held at the Auditorium Hotel, Chicago, on Wednesday evening, October 28, with approximately 170 present. J. J. Pelley, operating vice-president of the Illinois Central System was the speaker.

The following officers were elected for the ensuing year: President, J. J. Desmond, roadmaster, Chicago Terminal division, Illinois Central, Chicago; first vice-president, E. D. Swift, engineer maintenance of way, Belt Railway, Chicago; second vice-president; Emil Rost, supervisor, Baltimore & Ohio Chicago Terminal, Chicago; secretary-treasurer, W. S. Lacher, managing editor, *Railway Engineering and Maintenance*, Chicago; members executive committee for two years: R. N. Wade, engineer maintenance of way, Chicago Rapid Transit Lines, Chicago; P. Maisenbacher, roadmaster, Elgin, Joliet & Eastern, Gary, Ind.; W. S. Boyce, Railroad Supply Company, Chicago; member of the executive committee for one year, G. G. Austin, general roadmaster, Chicago Junction Railway, Chicago.

The next meeting of the association will be held on November 18 at which time J. G. Stuart, general storekeeper of the Chicago, Burlington & Quincy, will speak on the relations between the stores and maintenance of way departments.

Directory of Associations

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, Richmond, Va., October 19-20, 1926.

AMERICAN RAILWAY ENGINEERING ASSOCIATION (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next convention, Congress Hotel, Chicago, March 9-11, 1926.

AMERICAN WOOD PRESERVERS' ASSOCIATION.—E. J. Stocking, secretary, 111 West Washington street, Chicago. Next convention January, 1926, Cleveland, Ohio.

BRIDGE AND BUILDING SUPPLY MEN'S ASSOCIATION.—B. J. Wilson, Pocket List of Railroad Officials, 605 Fischer Building, Chicago. Annual exhibit at convention of American Railway Bridge and Building Association.

NATIONAL ASSOCIATION OF RAILROAD TIE PRODUCERS.—J. S. Penney, secretary, T. J. Moss Tie Company, St. Louis, Mo. Next convention January, 1926, Cleveland, Ohio.

NATIONAL RAILWAY APPLIANCES ASSOCIATION.—C. W. Kelly, secretary, Seeberger Building, 825 South Wabash avenue, Chicago. Annual exhibition at convention of American Railway Engineering Association.

ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention at Chicago.

TRACK SUPPLY ASSOCIATION.—W. C. Kidd, Ramapo-Ajax Corporation, Hillburn, N. Y. Annual Exhibit at convention of Roadmasters' and Maintenance of Way Association.

The Material Market

AT NO TIME since the early part of the present year have all indications pointed more definitely to the prospect of steady if not higher prices for iron and steel products. Sales and production have increased. During the month of September the production of steel ingots in the United States was 3,492,904 tons, or 77 per cent of the estimated capacity of the mills. At the end of Sepember the unfilled orders of the United States Steel Corporation totaled 3,717,297 tons, an increase over the total at the end of August of 204,494 tons, which represents the first increase in unfilled orders since February. It should be said in passing that orders for steel rails totaling 500,000 tons, placed largely in recent weeks, comprise one of the most important factors in the increased volume of steel purchases. Many contracts for rail are pending, and orders for track fastenings, are expected to appear in large volume in connection with the rail orders. Prices are stronger, but few definite advances have been noted thus far.

PRICES PER 100 LB.

	Pittsburgh	Chicago	Pittsburgh	Chicago
	September		October	
Track spikes	$2.80 to $3.00	$2.80 to $3.00	$2.80 to $3.00	$2.80 to $3.00
Track bolts	3.90 to 4.25	3.90 to 4.00	3.90 to 4.25	3.90 to 4.25
Angle bars	2.75	2.75	2.75	2.75
Tie plates, steel	2.35 to 2.40	2.35 to 2.40	2.35 to 2.40	2.35 to 2.40
Boat spikes	3.25	3.25	3.25	3.25
Plain wire	2.50	2.55	2.50	2.55
Wire nails	2.65	2.75	2.60 to 2.65	2.65 to 2.70
Barb wire, galv.	3.35	3.40	3.35	3.40
C. I. pipe, 6 in. to 12 in., ton		49.20		
Plates	1.80 to 1.90	2.10	1.80 to 1.90	2.10
Shapes	1.90	2.10	1.90 to 2.00	2.10
Bars, soft steel	2.00	2.10	2.00	2.10
Rivets, struct.	2.40 to 2.50	2.60 to 2.65	2.40 to 2.50	2.60 to 2.65
Conc. bars, billet	1.90 to 2.00		2.00	
Conc. bars, rail		2.00		2.00
Rail, per gross ton, f. o. b. mill		43.00		43.00

Prices of scrap suffered further decline during the early part of the month, but now show a healthier tone. Business is more active in this field and a number of railroads have placed large tonnages on the market.

PRICES PER GROSS TON AT CHICAGO

	September	October
Relaying rails	$26.00 to $31.00	$26.50 to $21.00
Rails for rerolling	19.00 to 19.50	18.50 to 19.00
Rails less than 3 ft. long	20.00 to 20.50	19.50 to 20.00
Frogs and switches cut apart	17.75 to 18.25	17.50 to 18.00
Steel angle bars	20.50 to 21.00	18.50 to 19.00

The lumber market shows little change other than a moderate tendency toward weakness, reflecting the seasonal tendency toward a curtailment of purchases at the approach of the period of decreased construction. The prices show little definite change.

SOUTHERN PINE MILL PRICES

	September	October
Flooring, 1x4, B and B flat	$47.11	$46.33
Boards, 1x8, No. 1	34.47	36.37
Dimension, 2x4, 16, No. 1, common	28.58	29.28
Dimension, 2x10, No. 1, common	32.20	30.67
Timbers, 4x4 to 8x8, No. 1	29.19	27.97
Timbers, 3x12 to 12x12, rough	34.65	36.75

DOUGLAS FIR MILL PRICES

Flooring, 1x4, No. 2, clear flat	$27.00	$27.00
Boards, 1x8, 6 to 20, No. 1, common	16.50	16.50
Dimension, 2x4, No. 1, common	17.50	17.50
Dimension, 2x10, 16, No. 1, common	17.00	17.00
Timbers, 6x6 to 8x8, No. 1, common	21.00	21.00
Timbers, 10x10 to 12x12, rough	18.00	18.00

Some reductions have been made in the prices of Portland cement, the table below including a number which represent a decrease of 10 cents per barrel as compared with previous quotations. The prices are for carload lots, not including package:

New York	$2.15	Minneapolis	$2.32
Pittsburgh	2.09	Dallas	2.05
New Orleans	2.40	Denver	2.84
Chicago	2.10	San Francisco	2.31
Cincinnati	2.37	Montreal	1.80

News of the Month

Operating revenues of the Class 1 roads for the eight months ending August 31 totaled $3,973,009,638 and operating expenses $3,010,642,425 leaving net revenues from railway operation of $962,366,213, and a railway operating income of $662,762,607, as compared with $562,425,203 for the first eight months of 1924. Maintenance of way expenses for the first eight months of 1925 totaled $540,745,817, as compared with $528,945,613 for the first eight months in 1924.

The volume of freight traffic carried by the railroads of this country in August totaled 41,723,156,000 net ton miles, according to reports filed by the carriers with the Bureau of Railway Economics. This was the greatest for any August on record with the exception of that of 1920, which exceeded it by 961,752,000 net ton miles or 2.3 per cent. The total for August this year, however, was an increase of 14.4 per cent over that of the same month last year and an increase of 3.4 per cent over that of August, 1923.

James Hume, a section laborer on the Chicago, Rock Island & Pacific at Zeandale, Kan., won the system golf tournament in Kansas City on October 10. This was one of the features of the seventy-third anniversary celebration of the Rock Island held in Kansas City, Kan., and Kansas City, Mo., on that date with an attendance of 6,000 employees, 400 of whom entered in various athletic tournaments forming a part of the celebration. Trophies of various kinds were awarded by J. E. Gorman, president, and Charles Hayden, chairman of the Board of Directors.

No decision has been announced as yet on the result of the hearing before the United States Railroad Labor Board on a plea for an advance in wages for maintenance of way employees in an ex-parte case brought before the board by the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers. The hearing closed on October 14, since when the time of the board has been taken up largely by labor controversies resulting in a strike of the enginemen on the Western Maryland and of the telegraphers on the Atlantic Coast Line.

With car loadings for the week ending October 10 totaling 1,106,099 cars, there has been a total of 12 weeks during the present year when the car loadings exceeded the million mark. While this record does not equal that of 1923, the average car loadings per week during the past year have been sufficiently above those of either 1923 or 1924 so that the cumulative total for the first 41 weeks of this year is considerably above that for the same period in the two years past, being 40,065,487 in 1925; 37,868,647 in 1924, and 39,468,953 in 1923.

The officers of the 609th Railway Engineers' Battalion, on the Chicago, Milwaukee & St. Paul, the personnel of which was brought up to war strength some time ago, met at Minneapolis, Minn., on September 18, to perfect plans for recruiting non-commisisoned officers and men and for completing the organization. Twenty-three officers were present, among whom were three company commanders. The plans calls for the enlistment of 200 men during the coming year. Norman A. Ryan, superintendent of the St. Paul, at Terre Haute, Ind., is the commanding officer of the battalion.

As a means of giving further impetus to the campaign for the promotion of improved practices in concrete mixing, the Portland Cement Association has developed a short course of instruction in concrete to be given under the auspices of its representatives in various parts of the country. These courses comprise evening classes for a period of two weeks covering such subjects as the water cement ratio, the analysis of aggregates, the designing of mixtures, the making and testing of specimens, etc. Courses have been given thus far at Birmingham, Ala., and Montgomery and Atlanta, Ga. and New Orleans.

The Northwestern Pacific, operating 500 miles of road with 2,500 employees, has not had an employee killed in an accident while on duty for over two years, the last employee fatality having occurred on September 24, 1923. The record of employees injured in 1924 showed an improvement of 32 per cent over 1923; and a 17 per cent reduction as compared with the preceding five years. The road has not had a passenger killed in train accident in the seven years that it has maintained a safety organization, although during this period eight passangers lost their lives in "train service" accidents, while trying to board or leave moving trains.

In the caving in of a tunnel of the Chesapeake & Ohio in Richmond, Va., on Friday evening, October 2, an engineman and a fireman were killed and 40 workmen had narrow escapes. The tunnel extends beneath the west side of Jefferson Park and is one which was abandoned several years ago. The workmen who were the victims were engaged in repair work preparatory to putting the tunnel again in service. A locomotive and several cars, which had just been run into the tunnel, were buried beneath a mass of earth near the western end. This tunnel was part of a line connecting the city with the lower river front and was completed in 1873. It was in regular use until 1902. Large masses of blue marl, softened by heavy rains, are said to have been the cause of the trouble.

The controversy between the Interstate Commerce Commission and the State of Illinois, arising over the project of the Illinois Central for a cut-off extending from Edgewood, Ill., to Fulton, Ky., has been taken before the Supreme court of the State of Illinois. The railroad has been granted a certificate of convenience and necessity from the Interstate Commerce Commission for the construction of this line, upon which work has been in progress for some time. The project is opposed by certain interests in the state because of the fear that it will divert considerable traffic from the old line between Edgewood and Fulton, thus decreasing the amount of money which the Illinois Central must pay the treasury of the state under its charter and reducing the expenditures of the railroad in its various terminals on the old line.

A reminder of the old days of competitive railroad building is afforded by the clash of opposing interests now occuring in central Oregon. The Southern Pacific, which will soon complete its Natron cut-off, proposes to complete a connection from Klamath Falls, Ore., to the northern end of the Nevada, California & Oregon, which it controls, for the purpose of providing a shorter route from Portland, Ore., to Ogden, Utah. On the other hand, the Northern Pacific and the Great Northern are both interested in the Oregon Trunk, a line owned by the former extending from the Columbia river up the Deschutes river to Bend, Ore., and are backing its application for authority to build an extension south to Klamath Falls, which is the center of what is now exclusively Southern Pacific territory. In a hearing opened on October 5 at Portland before Charles B. Mahaffie, director of finance for the Interstate Commerce Commission, representatives of the two opposing interests presented objections to each other's projects.

Personal Mention

General

Martin W. Clement, who has been promoted to assistant vice-president in charge of operations of the Pennsylvania, was born on December 5, 1881, at Sunbury, Pa., and was educated at Trinity College, Hartford, Conn. He entered the service of the Pennsylvania on August 1, 1901, as a rodman in the office of the principal assistant engineer of the United Railroads of New Jersey. He served successively as transitman and assistant supervisor, and on January 1, 1910, was promoted to supervisor in the office of the general manager. On June 16, 1913, Mr. Clement was transferred to the Manhattan division, and on December 1, 1913, he was transferred to the Pittsburgh division, to act in the same capacity. On December 1, 1914, he was transferred to the New York, Philadelphia & Norfolk, as division engineer, and on August 8, 1916, he returned to the Pennsylvania as division engineer to study improvements in and around New York. He became division engineer under the principal assistant engineer of the New Jersey division on November 15, 1916, and on June 16, 1917, was appointed superintendent of the New York, Philadelphia & Norfolk. After serving in various other capacities, he was promoted to general superintendent on March 20, 1920. On March 1, 1923, he was promoted to general manager of the Central region, with headquarters at Pittsburgh, Pa., which position he held at the time of his recent promotion to assistant vice-president in charge of operation.

M. W. Clement

Samuel Rea, president of the Pennsylvania, and, like many of his predecessors, an engineer, reached the age of 70 on Monday, September 21, and retired from active service on October 1, in accordance with the pension rules of the company. Mr. Rea was born on September 21, 1855, at Hollidaysburg, Blair county, Pa., and entered railway service on July 17, 1871, being for two years engaged in engineering work on the Morrison's Cove, Williamsburg and Bloomfield branches of the Pennsylvania. From 1874 to 1875 he held a clerical position with the Holiday Iron & Nail Company, in 1875 re-entering the service of the Pennsylvania in the engineering corps, where he was for two years assistant engineer in charge of the construction of the chain suspension bridge over the Monongahela river at Pittsburgh, Pa. From 1877 to 1879 he served as an assistant engineer on the Pittsburgh & Lake Erie, in the latter year taking charge of the construction of the extension of the Pittsburgh, Virginia & Charleston. At the end of the same year he became engineer in charge of surveys in Westmoreland county, Pa., also having charge of the revising and rebuilding of the Western Pennsylvania Railroad. In 1883 he was made principal assistant engineer, which position he held until 1888, when he was made assistant to the second vice-president, remaining in this position until 1899, when he left the Pennsylvania to become vice-president of the Maryland Central and chief engineer of the Baltimore Belt Railroad. From April, 1891, to May 25, 1892, he was out of railway service, returning on the latter date as assistant to the president of the Pennsylvania, which position he held until February 10, 1897, when he was promoted to first assistant to the president. He held this position until June 14, 1899, when he was elected fourth vice-president of the system east of Pittsburgh, Pa., and Erie. From October 10, 1905, to March 24, 1909, he served as third vice-president, on the latter date becoming second vice-president. Mr. Rea was made first vice-president on March 3, 1911, which position he held until May 8, 1912, when he was made vice-president of the same system in direct charge of the Hudson river tunnel and the New York terminal improvements. From January 1, 1913, until the time of his retirement, he served as president of the Pennsylvania Railroad System and the re-organiazed Pennsylvania System.

Samuel Rea

J. A. Rogers, division engineer on the Saskatoon division of the Canadian National, with headquarters at Saskatoon, Sask., has been appointed acting assistant superintendent of the same division with the same headquarters, succeeding **J. W. Crane,** assigned to other duties.

F. H. McGuigan, assistant to president of the Railway Car Manufacturers Association, New York, and formerly regional engineer of the United States Railroad Administration at Chicago in charge of western lines, has been appointed engineering assistant to the executive vice-president of the Gulf Coast Lines, with headquarters at Houston, Tex.

Engineering

A. O. Wilson has been appointed division engineer of the Seaboard Air Line, with headquarters at Sebring, Fla.

W. E. Moran has been appointed engineer of fire protection of the Cleveland, Cincinnati, Chicago & St. Louis, succeeding **E. N. Floyd,** resigned.

James MacMartin, chief engineer of the Delaware & Hudson, has been appointed chairman of the valuation committee, to succeed **George H. Burgess,** resigned. Mr. MacMartin will perform the duties of that office in addition to his regular duties.

R. E. Van Atta, whose promotion to engineering assistant to the vice-president and general manager of the Kansas City southern, with headquarters at Kansas City, Mo., was reported in the August issue, entered railway service in 1901, serving as rodman, instrumentman and draftsman on the Little Kanawha and other Gould Syndicate lines in West Virginia and southeastern Ohio. From June, 1906, to September, 1908, he was employed as a draftsman on the Kansas City Southern, and from November, 1910, until his recent promotion, he served respectively as draftsman, assistant chief draftsman, assistant engineer, principal assistant engineer and office engineer.

W. E. Heimerdinger, whose promotion to division engineer on the Chicago, Rock Island & Pacific at Cedar Rapids, Iowa, was reported in the October issue, was born at Vulcan, Mich., on February 12, 1889, and received his engineering education at the University of Michigan. He entered railway service on the Rock Island in 1911 as assistant on the engineering corps, since which time he has held the following positions: Rodman, building inspector, instrumentman, assistant engineer, office engineer of the First district, division engineer of the Des Moines Valley division, resident engineer on construction and location engineer. He was serving as assistant engineer at Des Moines when he was promoted to division engineer at Cedar Rapids, Iowa.

Track

O. L. Rinhart has been promoted to roadmaster of the Colorado division of the Atchison, Topeka & Santa Fe, with headquarters at Pueblo, Colo., suceeding **T. A. Blair.**

W. M. Bell has been appointed roadmaster of the Newport and Orford subdivisions of the Canadian Pacific, with headquarters at Farnham, Que., succeeding **J. Gagne,** who has been transferred.

S. K. Kimball, roadmaster on the Canadian National, has been transferred to the Regina division, with headquarters at Regina, Sask., suceeding **C. F. Werseen,** who resigned on September 17.

C. D. Turley, assistant engineer on the staff of the chief engineer maintenance of way of the Illinois Central System, with headquarters at Chicago, has been promoted to track supervisor in charge of a newly created sub-division on the Chicago Terminal division, with headquarters at Chicago.

J. M. Harper, supervisor on the New Orleans division of the Yazoo & Mississippi Valley lines of the Illinois Central System, with headquarters at Harriston, Miss., has been promoted to roadmaster in charge of the Gulf & Ship Island, a subsidiary of the Illinois Central, with headquarters at Hattiesburg, Miss., succeeding J. W. Collins, who has been assigned to other duties.

John Quill, track supervisor of the St. Louis division of the Baltimore & Ohio, with headquarters at Vincennes, Ind., has been transferred to the Cincinnati terminal, succeeding **J. Farrell. L. Sanders,** track supervisor on the St. Louis division at Flora, Ill., has been transferred to Vincennes, Ind., succeeding Mr. Quill. **G. B. Shouse,** assistant on an engineering corps at Washington, Ind., has been promoted to track supervisor at Flora, Ill., succeeding Mr. Sanders.

W. F. Fife, roadmaster of the Middle division, Lake Erie & Western district, of the New York, Chicago & St. Louis at Tipton, Ind., has been appointed supervisor of track of the Ft. Wayne division, Nickle Plate district, with headquarters at Bellevue, Ohio, succeeding **G. Blair,** resigned. **J. H. Dunn,** general foreman of the Ft. Wayne division at Muncie, Ind., has been promoted to roadmaster of the Middle division, with headquarters at Tipton, Ind., succeeding Mr. Fife. **W. J. Siffin** has been appointed general foreman of the Ft. Wayne division at Muncie, succeeding Mr. Dunn.

H. H. Notley, whose appointment as roadmaster of the Marysville district of the Sacramento division of the Southern Pacific, with headquarters at Marysville, Cal., was noted in the October issue, was born in England on January 22, 1876, and entered railway service as a section laborer on the Canadian Pacific in May, 1893. He was promoted to section foreman on April 1, 1898, and to extra gang foreman on June 1, 1907, holding this position until January 1909, when he left this road. Six months later he entered the service of the Southern Pacific at Oakland, Cal., as an extra gang foreman on the electrification of suburban lines, where he remained until the completion of this work in October, 1913, when he was transferred to the Los Angeles division as a section and extra gang foreman. He was promoted to general foreman on the Indio district on November 1, 1923, which position he was holding at the time of his recent promotion to roadmaster.

Bridge and Building

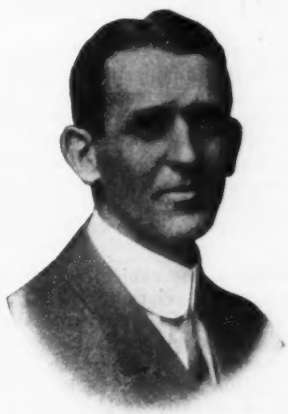
F. M. Case, foreman of water service on the Iowa and Minnesota division of the Chicago & North Western, with headquarters at Belle Plaine, Iowa, has been promoted to general foreman of water supply on the Iowa division, with headquarters at Boone, Iowa.

W. R. Hale, whose promotion to bridge and building supervisor of the Austin division of the Southern Pacific lines, with headquarters at Austin, Tex., was reported in the July issue, was born on April 10, 1867, at Franklin, Tex., and entered railway service in a bridge gang on the Houston & Texas Central, now operated by the Southern Pacific, on October 7, 1887, holding this position until 1895, when he was promoted to section foreman. From 1899 to 1902 he served as a brakeman, in the latter year becoming bridge foreman, which position he held until 1913, when he was made bridge supervisor. He was again made bridge foreman in 1922, which position he was holding at the time of his reecnt promotion to supervisor bridges and buildings.

Obituary

N. D. Miller, formerly chief engineer of the Great Northern and the Spokane, Portland & Seattle, died at St. Paul, Minn., on October 9. Mr. Miller was born on June 20, 1845, near Vernon, Vt., and, having moved to Minnesota as a child, he was educated in the public schools of St. Paul. All of his life from the age of 18 was spent in civil engineering work in the Northwest, the greater part of it in the service of the Great Northern and its antecedent and subsidiary lines. He was chief engineer of that road from January, 1885, to January, 1895, and again from May, 1898, to May, 1899. From October, 1905, to May, 1908, he was chief engineer of the Spokane, Portland & Seattle, during which time the main line of that company was built from Spokane to Portland. Mr. Nelson retired from active service in 1915, and continued to live in St. Paul until the time of his death at the age of 81.

Carl E. Gosline, track engineer of the Delaware, Lackawanna & Western, with headquarters at Hoboken, N. J., whose death on September 28 was reported in the October issue, was born on February 14, 1880, at Beaver, Pa. He entered railway service in 1902 with the Pittsburgh, Cincinnati, Chicago & St. Louis, leaving that road to attend the Pennsylvania State College, from which he graduated in 1906. He returned to the Pittsburgh, Cincinnati, Chicago & St. Louis in 1907, where he remained until 1908, when he became an assistant in the engineering corps on the Chicago & Eastern Illinois. From July, 1908, to November, 1909, he served as a timber treating inspector, first on the Chicago & Eastern Illinois and subsequently on the Chicago Rock Island & Pacific. In November, 1909, he left the Rock Island to become treating inspector for the Delaware, Lackawanna & Western, remaining in this position until May, 1921, when he was promoted to roadmaster, with headquarters at Hoboken. He was appointed track engineer, with the same headquarters, on March 1, 1923, which position he was holding at the time of his death.



Carl E. Gosline

John A. Kerwin, the oldest member of the Roadmasters and Maintenance of Way Association, and twice its president, died at his home in Alton, Ill., on October 19. Mr. Kerwin was born in Ireland in 1851 and came to this country as a boy of 12. Four years later, when 16, he entered the service of the Chicago & North Western as a trackman at Beloit, being advanced later to section foreman and again some years later to roadmaster at Madison, Wis., which position he held until 1897. In 1899 he was appointed roadmaster on the Missouri-Kansas-Texas at Parsons, Kan., where he remained until 1904, when he took a similar position with the Missouri Pacific at Chester, Ill. In 1914 he went to the Chicago, Peoria & St. Louis as roadmaster in charge of all track maintenance on that railroad and continued in this position until the early part of 1924, when he retired from active service. Mr. Kerwin joined the Roadmasters Association in 1884, and for some years had had the distinction of being its oldest living member. He had always had an active part in its affairs, serving as president in 1904 and again in 1908.

Construction News

The Atchison, Topeka & Santa Fe is now making surveys in contemplation of the construction of a line from Ft. Worth, Tex., northwest to Post or some other point farther north on its line from southern Texas to the west, a distance of approximately 230 miles.

The Boston & Albany has awarded a contract to the Tredenneck-Billings Company, Boston, Mass., for the building of canopies, platforms and penthouses for the new passenger station under construction at Springfield, Mass.

The Brooksville & Inverness has been authorized by the Interstate Commerce Commission to construct a line from a connection with the Tampa Northern at Brooksville, Fla., northerly to a connection with the Seaboard Air Line at or near Holder, a distance of 18.7 miles. The purpose of the new line is to give the S. A. L. a new route into Tampa and the S. A. L. plans to acquire all the new company's capital stock and lease it subject to the approval of the I. C. C. The estimated cost of construction exclusive of equipment is $782,355. Construction must begin by January 1, 1926, and be completed by the end of the year.

The Canadian National awarded a contract to the Jamieson Construction Company, Ltd., Edmonton, Alta., for the laying of 7,700 ft. of pipe line at New Bridgen, Alta. The contract also calls for the construction of a frame pump house on a concrete foundation.

The Canadian Pacific has completed surveys to determine the cost of a one-track tunnel between the Burrard Inlet, Vancouver, B. C., and False Creek yards, in contemplation of the construction of the tunnel by the railways jointly with the city of Vancouver, B. C. The estimate of the cost has been announced as $1,700,000. This company has prepared plans for the construction of an annex of 100 rooms to its hotel at Banff, Alta. A contract for the construction is reported to have been awarded to the Bennett & White Construction Co., Calgary, Alta.

The Los Angeles Union Station is the subject of a complaint by the Central Development Association of Los Angeles filed with the California Railroad Commission against the Southern Pacific, the Atchison, Topeka & Santa Fe and the Union Pacific, asking the commission to order the roads to join in a union passenger station in Los Angeles. The Interstate Commerce Commission recently decided that the California Railroad Commission had power to enforce the building of the union station. The California Railroad Commission will hold a hearing in Los Angeles, Cal., on November 30 to consider the entire problem.

The Chicago & Alton has awarded a contract to the Lehrack Contracting & Engineering Company for the construction of a grain elevator and tracks at Kansas City, Mo., to cost $450,000.

The Chicago & North Western has made application to the Interstate Commerce Commission for permission to construct a connecting link between the Southern terminus of its Southern Illinois division and a point on the Litchfield & Madison, near Staunton, Ill. The control of the Litchfield & Madison was recently acquired by the Chicago & North Western. This company closed bids on October 7 for the construction of a 15,000 gal. per hour water treating plant at South Norfolk, Neb.

The Chicago, Burlington & Quincy has given a contract to the Howlett Construction Company, Moline, Ill., for the construction of a 200-ton automatic coaling station of steel construction at Barstow, Ill.

The Chicago, Milwaukee & St. Paul has awarded a contract to the Joseph E. Nelson Company for six water-treating plants to be installed at Madison and Egan, S. D. and at Chandler, Fulda, Okabena and Jackson, Minn. Those at Madison and Jackson will have a capacity of 12,000 gal. per hour, and the others will have a capacity of 6,000 gal. per hour. All the tanks will be of wood.

The Chicago, Rock Island & Pacific is asking for bids on the construction of 14 additional stalls for its roundhouse at Silvis, Ill., which, including the lengthening of pits, is estimated to cost $75,000. The Interstate Commerce Commission has extended to November 1, 1925, the date before which construction of this company's proposed Billings-Owens (Oklahoma) line must be begun.

The Cleveland, Cincinnati, Chicago & St. Louis has awarded a contract to the Walsh Construction Company, Davenport, Ia., for one mile of second main track work at Bellefontaine, Ohio. A contract has been let to this company for masonry work and excavation for the Dennison avenue grade separation at Columbus, Ohio, at an estimated cost of $85,000. It has let a contract to this company for the grading for the second main track and relocation from Gretna, Ohio, to Quincy. The masonry work has been awarded to the Mead-Balch Construction Company, Indianapolis, Ind. The I. D. Tuttle Company, Springfield, Ohio, was awarded a subcontract for part of the masonry work. The estimated cost of the latter is $1,300,000. This company is constructing a tie adzing plant with company forces, at Indianapolis, Ind., at an estimated cost of $45,000.

The Great Northern has authorized the construction of a 250-ton steel coal chute at Sand Point, Idaho.

The Illinois Central has awarded a contract to the Ellington Miller Company, Chicago, for the construction of superstructures of an office building and a blacksmith shop at Paducah, Ky. This is a part of the large terminal now being constructed at Paducah, as reported in the October issue.

The Kansas City Southern is now making a number of improvements to its facilities at Shreveport, La., including a 54-ft. extension to its storehouse and other changes estimated to cost $33,772; the building of 12,720 ft. of tracks to serve a new industrial district on Douglas Island at an estimated cost of $164,625; and a new yard at an estimated cost of $454,000. All of this work is being done by company forces except the construction of a bridge over Cross Bayou on the Douglas Island line for which a contract has been let to the Topeka Bridge & Construction Co.

The Kentucky & Indiana Terminal has awarded a contract to the T. S. Leake Construction Company for the construction of a shop building, a storehouse and an office building at Louisville, Ky., to cost $82,000.

The Louisville & Nashville will construct a bridge over the Cumberland river at Baxter, Ky. A contract has been awarded to the Gould Contracting Company, Nashville, Tenn., for the construction of a bridge over the Tennessee river at Knoxville, Tenn., consisting of two 205-ft. deck trusses and one 271-ft. through truss span to cost approximately $212,000.

The Minneapolis & St. Louis has given a contract to the Howlett Construction Company, Moline, Ill., for the construction of a frame automatic coaling station of 200 tons' capacity at Montgomery, Minn., and another of 150 tons at Olds, Iowa.

The Minnesota Western has applied to the Interstate Commerce Commission for a certificate authorizing the construction of an extension from Lake Lillian to Dawson, Minn., 57 miles.

The Missouri Pacific has awarded a contract to the Eberhardt Construction Company, Salina, Kan., for the construction of a seven-stall enginehouse at Arkansas City, Kan., to cost approximately $32,530. A contract has been awarded to W. P. McGeorge & Co., Pine Bluff, Ark., for the construction of 3.3 miles of spur track to Columbia Quarry, Columbia, Ill., to cost approxiamtely $166,400. A contract has been awarded to the Bilhorn Construction Company, St. Louis, Mo., for the construction of a four-mile spur track to Old Ben Mine No. 14 at Zeigler, Ill., to cost approximately $143,000. A contract has been awarded to T. H. Johnson, Sedalia, Mo., for the construction of a street subway at Nevada, Mo., to cost approximately $98,000. A contract has been awarded to the List & Weatherly Construction Company, St. Louis, Mo., for the strengthening of the White river bridge at New Augusta, Ark., to cost approximately $93,000.

The New York Central has announced that it is seriously

considering the erection of a new modern mail handling terminal at Albany, N. Y.

The Northern Pacific is reported to have awarded a contract to the Donovan Company, St. Paul, Minn., for the construction of a dam and spillway near East Helena, Mont., to cost approximately $50,000. This company has awarded a general contract to Twohy Bros., Spokane, Wash., for the construction of a 50-mile branch line from Orofino, Idaho, into the Clearwater timber district of northern Idaho. This project was reported in the October issue.

The Oklahoma & Rich Mountain has applied to the Interstate Commerce Commission for a certificate authorizing the construction of a line from Page to Talihina, Okla., 35 miles. F. H. Dierks, Kansas City, Mo., is president of the company.

The Oregon Short Line is constructing a corrugated iron and frame lumber shed, 50 by 405 ft., at Pocatello, Idaho, estimated to cost $56,000. It is also constructing a train shed, 172 by 25 ft., including umbrella sheds at Salt Lake City, Utah, at an estimated cost of $77,000. The work is being done by company forces. A contract has been awarded to H. W. Bauv Company, Salt Lake City, Utah, for the construction of a restaurant building at West Yellowstone, Mont., estimated to cost $86,000.

The Pacific Electric contemplates the construction of two additional tracks to make a four-track line from Los Angeles, Cal., to Venice, a distance of approximately 20 miles.

The Pennsylvania has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a reinforced concrete automatic electric coaling plant at Phillipsburg, N. J. A contract has been awarded to Henry Steers, Inc., New York, for the foundations and concrete platforms for the building to be constructed at the company's Sunnyside yards, Long Island City, N. Y., for the use of the American Railway Express Company; approximate cost, $150,000. A contract has been awarded to the T. J. Foley Company, Pittsburgh, Pa., for grading and masonry in connection with an under grade bridge to eliminate the grade crossing at Dennison avenue, Columbus, Ohio, to cost $350,000.

This company in the near future will begin the construction, in South Philadelphia, Pa., of a new produce yard and other extensive facilities for handling fruit and vegetable traffic. Included among the facilities will be two one-story freight sheds, 100 ft. by 650 ft., necessary tracks, and a cold storage warehouse having a storage area of 75,000 sq. ft. It is expected that the entire project, as now contemplated, will, upon complete development, represent an investment approximating $3,000,000.

The Pere Marquette is making extensions to its Oak yard, Detroit, Mich., with company forces. The estimated cost is $125,000.

The Reading, through the Philadelphia Grain Elevator Company, a subsidiary of this road, has awarded a contract to the M. A. Long Company, Baltimore, for the construction at Port Richmond, Philadelphia, of a grain elevator, having capacity of 2,500,000 bu., which will cost $4,000,000.

The Sacramento Northern has applied to the California Railroad Commission for permission to construct a line from Lisbon, Cal., through the Holland reclamation district, for a distance of 13 miles. This company has also applied to the Interstate Commerce Commission for authority to acquire trackage rights over portions of the San Francisco-Sacramento between West Sacramento and Lisbon, Cal., 8 miles, to construct 13 miles of line from Lisbon to Reclamation District No. 999.

The Southern Pacific has authorized the construction of the following new lines, with the lengths and costs indicated: Black Butte, Cal., to Grass Lake, 23 miles, $3,700,000 (this project was recently approved by the Interstate Commerce Commission); Valley Springs, Cal., to North Fork, 8 miles, $575,000; Hinsdale, Cal., northerly into reclamation district, 5 miles, $331,000; 22,355 ft. of additional yard tracks at Oakland, Cal., to cost $100,000; a new creosoting plant, at Oakland, to cost $520,000; a brick station with stucco exterior and tile roof at Reno, Nev., to cost $84,000; four fuel oil plants, consisting of 350,000 gal. reinforced concrete sumps, oil columns, pump houses and track facilities at El Paso, Tex.; Hachita, N. Mex.; Noria, N. Mex., and Douglas, Ariz., to cost a total of $66,000; 4,600 ft. of creosoted pile bulkhead and filling of submerged land with material dredged from channels, at Long Beach, Cal., to cost $245,000, and a creosoting plant at Blair, Ore., to cost $350,000.

Plans have been prepared for the construction of a roundhouse at Santa Barbara, Cal., to replace a building which was destroyed by an earthquake several months ago. The new roundhouse will be in mission style with stucco exterior and a red tile roof. Plans are reported to have been prepared for the construction of a passenger station at Calexico, Cal., to cost approximately $60,000.

The Terminal Railroad Association of St. Louis will construct next year a reinforced concrete viaduct to carry highway traffic across the terminal tracks at Penrose Park, St. Louis, Mo., following the settlement of the dispute over the distribution of the cost between the city and the railroad. Under the agreement between the city and the railroad which has been under dispute for five years, the road will pay $125,000 of the total cost of $210,000. The Board of Public Service of St. Louis also has accepted the road's proposal to pay the entire cost of extending the Jefferson avenue viaduct north over the proposed new yard.

The Texas & Pacific has awarded a contract to the V. E. Ware Company, El Paso, Tex., for the construction of a seven-stall brick roundhouse, a brick machine and blacksmith shop, a brick storeroom and a frame car repair shed at Dallas, Tex., to cost approximately $135,000.

Equipment and Supplies

The railroads are now making inquiries and placing orders for their requirements of rail during 1926. Orders were placed recently as follows:

	Tons	
Illinois Central	28,000	Tennessee Coal, Iron & R. R. Co.
Illinois Central	32,000	Illinois Steel Company.
Chicago & North Western	25.000	Illinois Steel Company
Union Pacific	18,000	Illinois Steel Company
Baltimore & Ohio	45,000	United States Steel Corp.
Baltimore & Ohio	35,000	Bethlehem Steel Company
Baltimore & Ohio	5,000	Inland Steel Company
Chicago, Milwaukee & St. Paul	40,000	Illinois Steel Company
Chicago, Milwaukee & St. Paul	10.000	Inland Steel Company
Southern Railway	39,200	Tennessee Coal, Iron & R. R. Co.
	4,000	Bethlehem Steel Company
	2,000	Illinois Steel Company
Atlantic Coast Line	43.000	Tennessee Coal, Iron & R. R. Co.
Northern Pacific	40,000	Bethlehem Steel Company Illinois Steel Company
Missouri Pacific	40,000	Illinois Steel Company Inland Steel Company Tennessee Coal, Iron & R. R. Co. Colorado Fuel & Iron Co.
Texas & Pacific	25,000	Tennessee Coal, Iron & R. R. Co.
Nash., Chatt. & St. Louis	8,500	Tennessee Coal, Iron & R. R. Co.
Alabama & Vicksburg	6,000	Tennessee Coal, Iron & R. R. Co.
Shreveport & Pacific	6,000	Tennessee Coal, Iron & R. R. Co.
Carolina Clinchfield & Ohio	6,000	Tennessee Coal, Iron & R. R. Co.
Florida East Coast	25,000	Tennessee Coal, Iron & R. R. Co.
Louisville & Nashville	72.000	Tennessee Coal, Iron & R. R. Co.
New York Central	88,500	Bethlehem Steel Co.
	80,445	Illinois Steel Co.
	18,800	Carnegie Steel Co.
	19,000	Inland Steel Co.

The Atchison, Topeka & Santa Fe is expected to enter the market soon for 100,000 tons of rails.

The Canadian Pacific has ordered 100 ballast cars from the Canadian Car & Foundry Company.

The Central of New Jersey has ordered 10 air dump cars from the Magor Car Corporation.

The Chesapeake & Ohio has ordered two 25-ton locomotive cranes from the McMyler Interstate Company. This company has ordered 4 air dump cars from the Case Crane & Engineering Company.

The Erie expects to enter the market for 30,000 tons of rail.

The International Great Northern is expected to come into the market soon for its 1926 rail requirements.

The Louisville & Nashville is asking for prices on from 3,000 to 4,000 tons of angle bars and from 2,500 to 3,000 tons of spikes and bolts.

The Southern Pacific is inquiring for 1,200 tons of track spikes.

Supply Trade News

General

The Federal Cement Tile Company, Chicago, has established a branch sales office at Indianapolis, Ind., in charge of **C. B. Baird.**

The Robert W. Hunt Company has opened a branch office and cement laboratory in the Alabama Power Company building, Birmingham, Ala. **T. C. Peace** is resident manager.

The Railroad Supply Company, Chicago, has purchased the Bryant Zinc Company, Chicago, manufacturers of highway crossing protection apparatus and signal accessories. There will be no change in the personnel or policy of either company. The business will be conducted as heretofore under the direction of the combined sales and engineering staff of both companies. **A. F. Klink, president** of the Bryant Zinc Company, has retired.

The consolidation of the **Weir Frog Company** of Cincinnati, Ohio, and the **Kilby Frog & Switch Company** of Birmingham, Ala., announced on page 372 of the September issue of *Railway Engineering and Maintenance*, has been carried to a conclusion by the organization of the **Weir Kilby Company.** The officers of this new corporation are: President, O. DeG. Vanderbilt, Jr.; vice-president, E. M. Kilby, and vice-president, J. K. Lansdowne.

Personal

A. E. Kistner has been appointed manager of the Cincinnati office of the **Truscon Steel Company,** to succeed A. Levinson, resigned.

Benjamin B. Shaw, formerly chief engineer of the Cuba Railroad, has been appointed contracting engineer of Roberts & Schaefer Co., Chicago.

Ward G. Day, for the past seven years in charge of the service department of **Fairmont Railway Motors, Inc.,** at Fairmont, Minn., has been promoted to special agent, with headquarters at New Orleans, La. Mr. Day's jurisdiction will cover the states of Texas, Louisiana, Mississippi, Alabama, Arkansas, Georgia and Florida. **Carl Brhel** has succeeded Mr. Day at Fairmont.

John B. Emerson, engineer of tests of the Rail committee of the Engineering division of the American Railway Association, has been appointed vice-president of **R. H. Laverie & Sons, Inc.,** New York City, and general manager in charge of the middle and southwestern territories, with headquarters in Chicago. R. H. Laverie & Sons, Inc., are the American representative of the Bureau Veritas of France, an international bureau of inspection and tests, and have specialized in commercial inspection work in this country for more than 20 years. With the opening of an office in Chicago, equipped with physical and chemical testing laboratories, this organization will enter more actively in competition for business of this character throughout the country. Mr. Emerson was born at Fond du Lac, Wis., on September 19, 1879, and graduated in chemical engineering from the University of Wisconsin in 1899. He entered the service of the Illinois Steel Company on graduation, remaining with that organization until 1905, when he went with the Mt. Vernon Car Manufacturing Company, Mt. Vernon, Ill., as metallurgist in charge of the car wheel foundry. In 1907 he entered the employ of Robert W. Hunt & Co. as manager of their St. Louis office. In 1917 he entered the Air Service of the United States Army as aeronautical mechanical engineer and after the armistice he was made finance officer in charge of the settlement of claims in the Pittsburgh district. In 1920 he went with the United Alloy Steel Corporation, Canton, Ohio, as engineer of tests, leaving that organization in 1922 to become metallurgical engineer for the Rail committee of the Engineering division of the American Railway Association. A year later he was appointed engineer of tests, which position he has since held. Mr. Emerson will retain his connection with the Rail committee as consulting engineer.

John B. Emerson

Thomas Franklin Manville, chairman of the board of directors of Johns-Manville, Incorporated, died suddenly on October 19, in New York City at the age of 63. Mr. Manville for the past 25 years has been the directing head of Johns-Manville, Incorporated, producer and manufacturer of asbetsos. His brother, H. E. Manville, who succeeded to the presidency of Johns-Manville, Incorporated, in 1924, has been closely identified with him during this entire period and will continue to direct the policies of the organization. T. F. Manville, in addition to serving as chairman of the board of directors of Johns-Manville, Incorporated, was president of the Arizona Asbestos Company; treasurer and director of the Asbestos Wood & Shingle Company; president and director of the Canadian Johns-Manville Company; director of The Fibre Corporation, and director of a number of other companies.

Trade Publications

Hydralt.—J. B. W. Gardner, Inc., New York, has issued a four-page pamphlet outlining the nature and characteristics of a new waterproofing material known as "hydralt." The description also outlines the manner of application and presents claims for the protection afforded against the corrosive action of acids, brine drippings, locomotive gases, etc.

Portable Air Compressors.—The Sullivan Machinery Company, Chicago, has issued a 32-page bulletin, No. 77-N, describing portable air compressors having capacities ranging from 110 to 258 cu. ft. of free air per minute. The equipment is described in detail with illustrations showing the character of construction and the application of the compressors to various classes of work.

Industrial Buildings.—The Austin Company, Cleveland, Ohio, has recently issued the eighth edition of its general catalog which contains illustrations and specifications of Austin standard, multistory and single story buildings. Several charts and tables show the trend of building costs and comparative insurance rates and a section is devoted to a technical description and relative costs of various types of floors, walls, roof structures, etc.

Sentinels of Service.—The Long-Bell Lumber Company, Kansas City, Mo., has issued an attractive booklet of 32 pages describing its creosoted yellow pine poles for signal and train control power lines and for telegraph and telephone service. The characteristics of this timber and the steps in the production and treatment of poles are described at length.

Advance Series Motor Cars.—For the purpose of outlining the advantages of its A2 and AT2 type motor cars, Fairmont Railway Motors Inc. Fairmont Minn. has issued Bulletin 205 of four pages descriptive of these cars, which are suitable for use by section gangs. The A2 is designed for single-speed transmission with either belt or chain drives, the AT2 having a belt drive and two-speed transmission. The bulletin is arranged in uniform style with previously issued bulletins

Diamond Drills.—The Sullivan Machinery Company, Chicago, has issued an 80-page catalog which comprises a treatise on diamond drilling such as is required for foundation exploration, investigation of old masonry and other engineering studies occasionally imposed on the engineering departments of railroads. The purpose and method of diamond drilling are explained and the machinery manufactured for carrying out this work is described in detail. Specific instructions are given for the method of operation.

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Ever Put on a Rail

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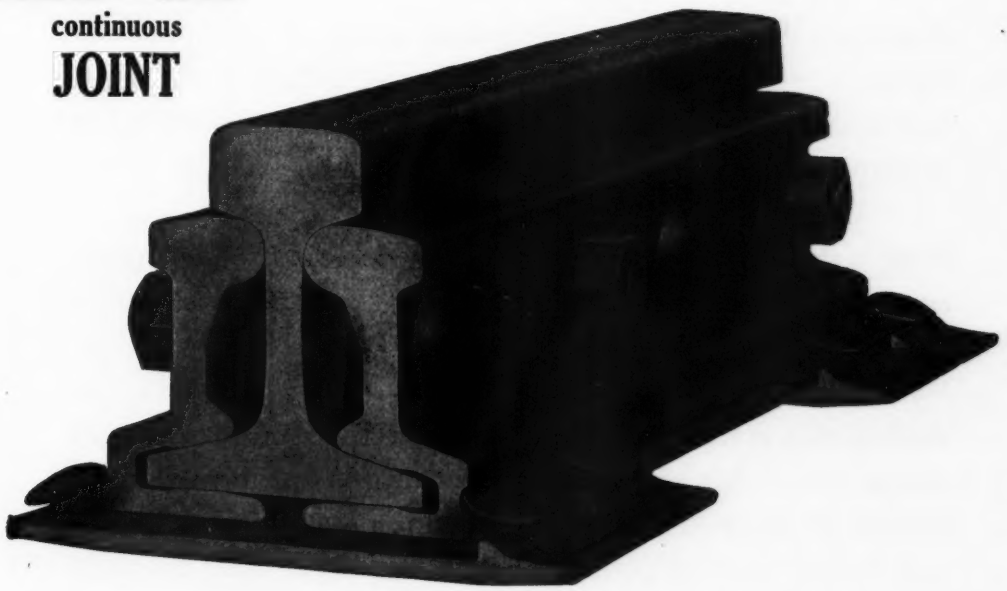

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Items are being included in the list as the necessities confront those in charge of expenditures and as convincing arguments in their behalf are presented to these officers.

It is important that your information and arguments regarding your products be presented while the budget is still open and while the construction or betterment programs are being determined.

Now is the time for manufacturers of devices used in maintenance of way or construction to bring them to the attention of the budget makers.

And as this is the best time to get into the field for the 1926 campaign, so also there is no better means for getting there, insofar as the engineering and maintenance of way field is concerned, than by giving information about your products through the columns of

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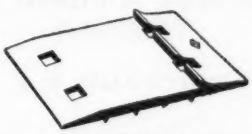

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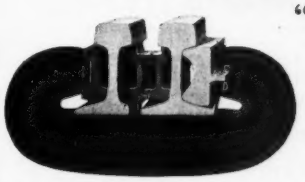

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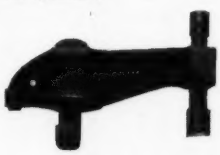

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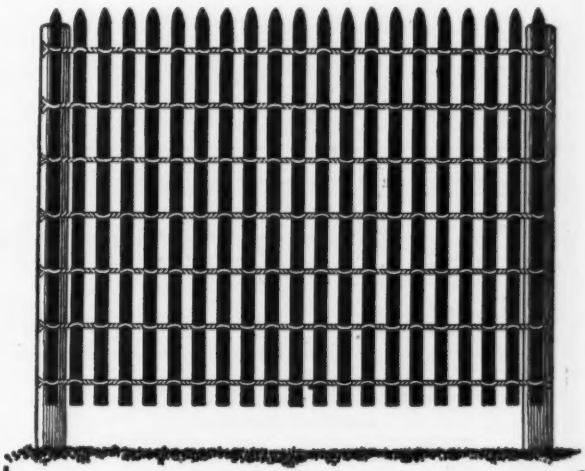

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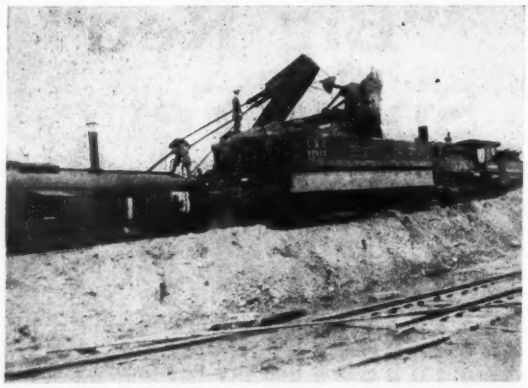

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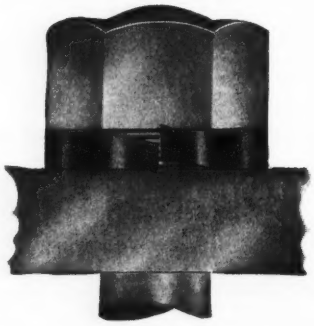

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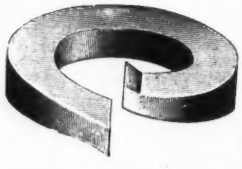

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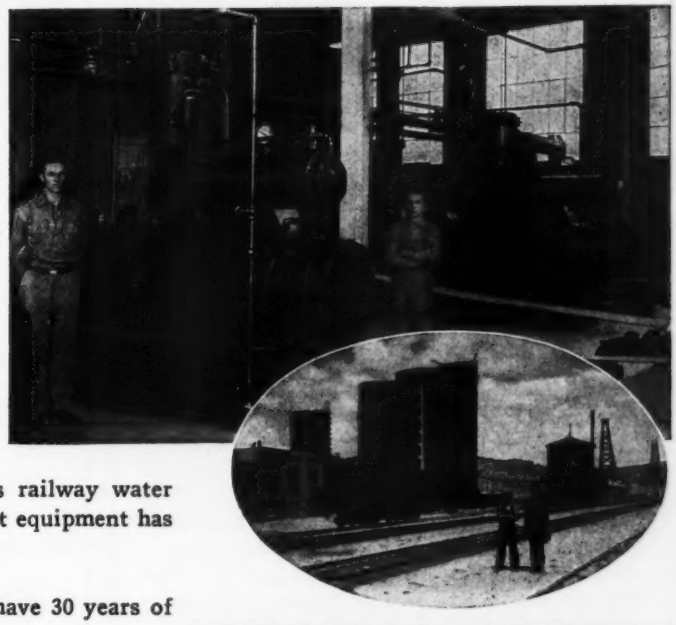
The compressor installation consists of two Sullivan Angle Compound Compressors, each driven by a belted Fairbanks Morse 100-H.P. oil engine. The plant represents the latest practice in water service and embodies the best in power economy, well output and dependability.



It is a typical example of the numerous railway water supply stations in which Sullivan Air Lift equipment has been installed during the past few years.

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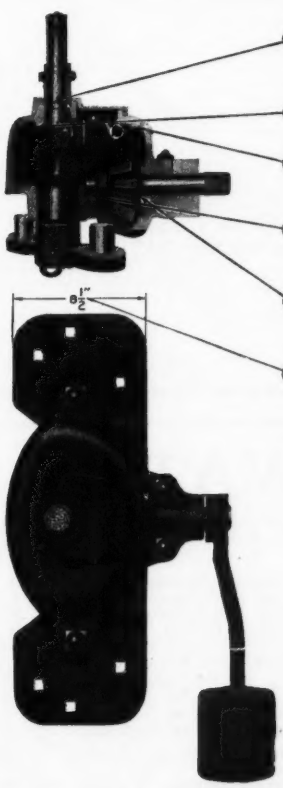
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8 1/2"
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Five of the new improvements on the New Century Switch Stand provide additional and larger bearings for the working parts of the stand, while the sixth improvement provides a broader base, greatly increasing the stability of the stand and lengthening the life of the switch ties. Particular attention is called to improvement No. 4, which provides an outboard bearing.

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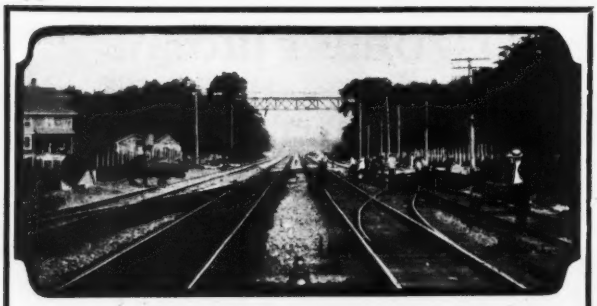

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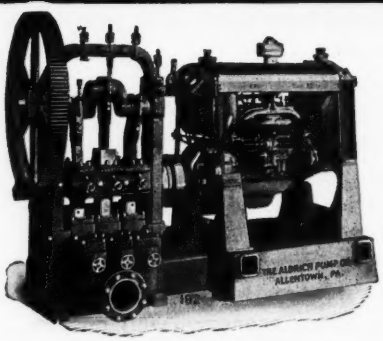

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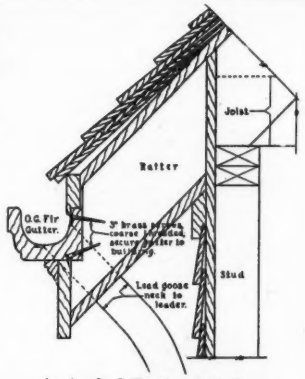

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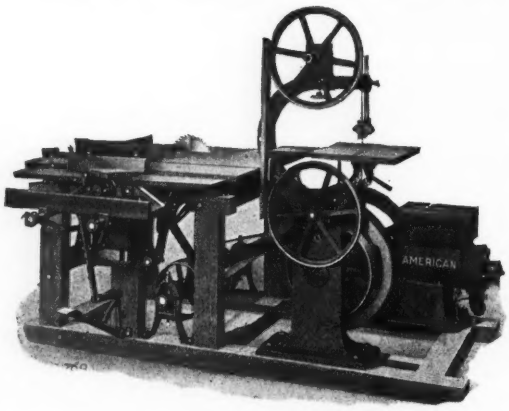

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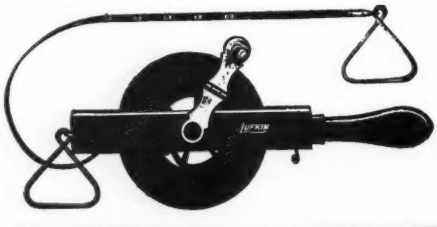

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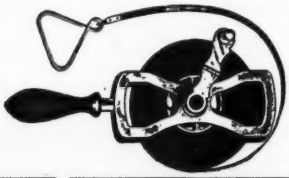

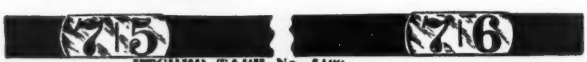

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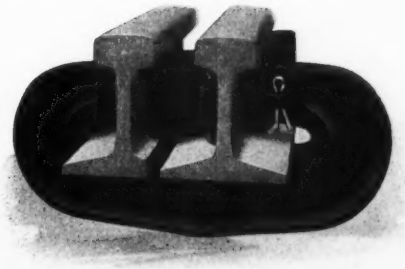

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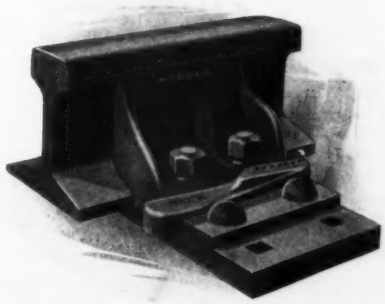

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Should be in use on all interlocked switches to insure an easy and close adjustment for taking up wear between rail, brace and plate.

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STATEMENT of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of *Railway Engineering and Maintenance*, published monthly at Chicago, Ill., for October 1, 1925.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared E. A. Simmons, who, having been duly sworn according to law, deposes and says that he is the President of the Simmons-Boardman Publishing Co., publisher of *Railway Engineering and Maintenance*, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

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Publisher, Simmons-Boardman Publishing Co., 30 Church St., New York, N. Y.

Editor, Elmer T. Howson, 608 South Dearborn St., Chicago, Ill.

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Sworn to and subscribed before me this 28th day of September, 1925.
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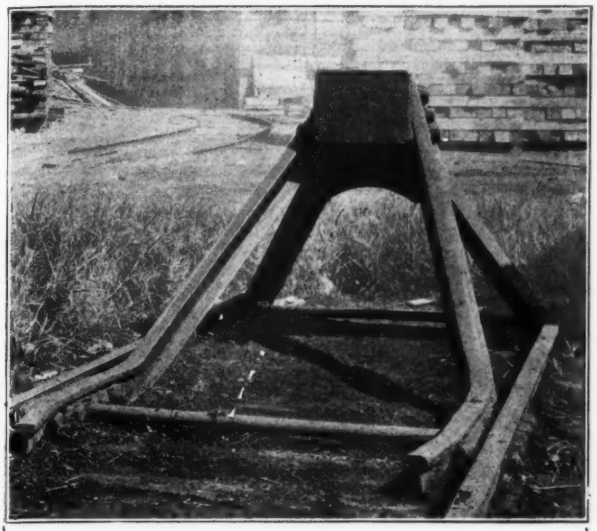
(My commission expires March 30, 1926.)



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Industrial Works.

Lubricants.
Dixon Crucible Co., Jos.

Machinery, Grading.
See Grading Machinery.

Manganese Track Work.
Bethlehem Steel Co.
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Frog Switch & Mfg. Co.
Kilby Frog & Switch Co.
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Q. & C. Co.
Ramapo-Ajax Corp.
Wharton, Jr., & Co., Inc., Wm.

Manholes.
Massey Concrete Products Corp.

Markers.
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Mile Posts.
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Motor Car Bearings.
Hyatt Roller Bearing Co.

Motor Cars.
See Cars, Motor.

Motors and Generators
Fairbanks, Morse & Co.

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Fairmont Railway Motors, Inc.

Nut Locks.
National Lock Washer Co.
Positive Lock Washer Co.
Reliance Manufacturing Co.
Verona Tool Works.

Nuts.
Bethlehem Steel Co.

Oil Engines.
See Engines, Oil.

Out Houses.
Massey Concrete Products Corp.

Oxygen.
Oxweld Railroad Service Co.

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Dixon Crucible Co., Jos.

Paint, Metal Protecting.
Barber Asphalt Co.
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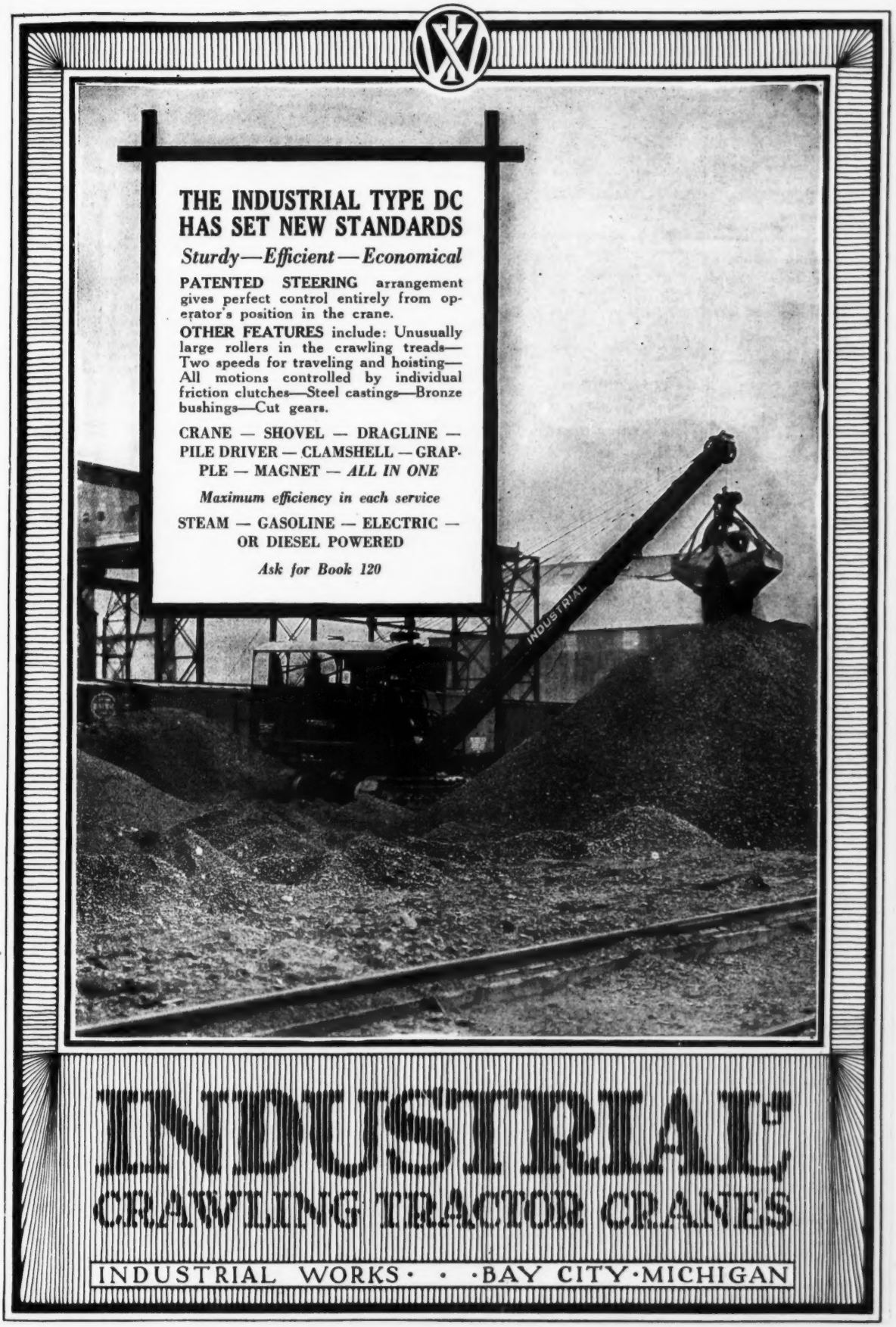

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Dixon Crucible Co., Jos.

Plows, Railroad.
Western Wheeled Scraper Co.

Poles.
International Creosoting & Construction Co.
Massey Concrete Products Corp.

Posts, Bumping.
See Bumping Posts.

Posts, Fence.
See Fence Posts.

Powders.
Du Pont de Nemours & Co., Inc., E. I.

Power Plants, Portable
Electric Tamper & Equipment Co.

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Rail Anchors.
American Fork & Hoe Co.
Lundie Engineering Corp.
P. & M. Co.

Rail Anti-Creepers.
See Anti-Creepers, Rail.

Rail Benders.
American Chain Co., Inc.
Buda Co.
Q. & C. Co.
Verona Tool Works.

Rail Bonds.
Verona Tool Works.

Rail Braces.
Bethlehem Steel Co.
Buda Co.
Morden Frog & Crossing Works
Q. & C. Co.
Ramapo-Ajax Corp.
Wharton, Jr., & Co., Inc., Wm.

Rail Joints.
See Joint, Rail.

Rail Saws, Portable.
Industrial Works.
Q. & C. Co.

Rails, Tee.
Bethlehem Steel Co.
Inland Steel Co.

Rail Springs.
Verona Tool Works.

Rams, Hydraulic.
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American Chain Co., Inc.
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Barber Asphalt Co.

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Section Cars.
See Cars, Section.

Sheathing, Paper
Barber Asphalt Co.

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Signal Foundations, Concrete.
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Spikes.
Bethlehem Steel Co.
Inland Steel Co.

Spreader Cars.
See Cars, Spreader.

Spreaders, Ballast.
See Ballast Spreaders.

Standpipes.
Chicago Bridge & Iron Works.

Standpipes (Penstock).
Fairbanks, Morse & Co.

Stands, Switch & Target.
Bethlehem Steel Co.
Q. & C. Co.
Ramapo-Ajax Corp.

Station Houses.
Massey Concrete Products Corp.

Steel Plates and Shapes.
Bethlehem Steel Co.

Step Joints.
See Joints, Step.

Structural Steel.
Bethlehem Steel Co.
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Surfacing Machinery, Concrete.
Concrete Surfacing Machinery Co.

Switches.
Bethlehem Steel Co.
Buda Co.
Frog Switch & Mfg. Co.
Kilby Frog & Switch Co.
Louisville Frog & Switch Co.
Morden Frog & Crossing Works
Ramapo Ajax Corp.
Wharton, Jr., & Co., Inc., Wm.

Switchmen's Houses.
Massey Concrete Products Corp.

Switchpoint Protectors
Fleming & Son Co., Inc., J. R.

Switchstands & Fixtures.
Bethlehem Steel Co.
Buda Co.
Morden Frog & Crossing Works
Ramapo Ajax Corp.

Tampers, Tie.
See Tie Tampers.

Tank Fixtures.
Fairbanks, Morse & Co.

Tanks, Elevated, Steel.
Chicago Bridge & Iron Works.
Massey Concrete Products Corp.

Tanks, Oil Storage.
Chicago Bridge & Iron Works.

Tanks, Water Storage.
Chicago Bridge & Iron Works.
Fairbanks, Morse & Co.

Tapes.
Lufkin Rule Co.

Tee Rails.
See Rails, Tee.

Telegraph Poles.
See Poles.

Thawing Outfits
Q. & C. Co.

Ties.
International Creosoting & Construction Co.

Tie Plate Clamps
Q. & C. Co.

Tie Plates.
Bethlehem Steel Co.
Inland Steel Co.
Lundie Engineering Corp.

Tie Rods.
Bethlehem Steel Co.

Tie Spacers
American Chain Co., Inc.
Co.

Tie Tampers.
Electric Tamper & Equipment Co.
Ingersoll-Rand Co.

Timber, Creosoted.
International Creosoting & Construction Co.

Tool Steel.
Bethlehem Steel Co.

Tools, Pneumatic.
Ingersoll-Rand Co.

Tools, Track.
Buda Co.
Hackmann Railway Supply Co.
Q. & C. Co.
Verona Tool Works.

Tools, Wrecking.
Industrial Works.

Torque Switches.
Bethlehem Steel Co.
Buda Co.
Frog Switch & Mfg. Co.
Kilby Frog & Switch Co.
Ramapo Ajax Corp.

Torches, Oxy-Acetylene Cutting & Welding.
Oxweld Railroad Service Co.

Tracing Cloth.
Pease Co., C. F.

Track Drills.
See Drills, Track.

Track Jacks.
See Jacks, Track.

Track Liners.
See Liners, Track.

Track, Portable.
Western Wheeled Scraper Co.

Track Scales
Fairbanks, Morse & Co.

Track Tools.
See Tools, Track.

Transfer Tables.
Industrial Works.

Treating Plants, Water.
American Water Softener Co.

Trestle Slabs.
Massey Concrete Products Corp.

Turntables
McMyler-Interstate Co.

Ventilators
Q. & C. Co.

Water Columns.
Fairbanks, Morse & Co.

Water Cranes.
Fairbanks, Morse & Co.

Water Softening Plants.
American Water Softener Co.
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Barber Asphalt Co.

Weed Burner.
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Welding, Oxy-Acetylene.
Oxweld Railroad Service Co.

Welding & Cutting Equipment.
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Wheels, Hand & Motor Car.
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Mudge & Co.
Northwestern Motor Co.
Parsons Co.
Woolery Machine Co.

Wood Grapples.
Industrial Works.

Wood Preservation.
See Preservation, Timber.

Woodworking Machinery.
American Saw Mill Machinery Co.

Wrecking Cranes.
Industrial Cranes.

ALPHABETICAL INDEX TO ADVERTISEMENTS

A

Aldrich Pump Co. 44
American Casting Co. 34
American Chain Co., Inc. 41
American Fork & Hoe Co. 36
American Saw Mill Machinery Co. 46
American Water Softener Co. 46
American Well Works 25
Armco Culvert & Flume Mfrs. Assn. 12

B

Barber Asphalt Co. 40
Bethlehem Steel Co. 43
Buda Co. 14

C

Chicago Bridge & Iron Works 4
Clark Car Co. 13
Chicago Steel Foundry Co. 49
Concrete Surfacing Machinery Co. 48

D

Dixon Crucible Co., Jos. 42
Du Pont de Nemours & Co., Inc., E. I. 32

E

Electric Tamper & Equipment Co. 9

F

Fairbanks, Morse & Co. 19-20
Fairmont Railway Motors, Inc. 17
Fleming & Sons Co., Inc., J. R. 53
Frog Switch & Manufacturing Co. 42

G

Gardner Governor Co. 16
Goulds Manufacturing Co. 40

H

Hackmann Railway Supply Co. 18
Hyatt Roller Bearing Co. 21

I

Illinois Wire & Mfg. Co. 41
Industrial Works 51
Ingersoll-Rand Co. 22
Inland Steel Co. 39
International Creosoting & Construction Co. 30

J

Jordan Co., O. F. 47

K

Kilby Frog & Switch Co. 48
Koppel Industrial Car & Equipment Co. 8

L

Linde Air Products Co. 28
Long & Sons, E. M. 44
Louisville Frog & Switch Co. 46
Lufkin Rule Co. 46
Lundie Engineering Corp. 23

M

McMyler-Interstate Co. 35
Magor Car Corp. 42
Massey Concrete Products Corp. 45
Mechanical Manufacturing Co. 49
Morden Frog & Crossing Works 47
Mudge & Co. 3

N

National Lock Washer Co. 10-11
Northwestern Motor Co. 33

O

Owen Bucket Co. 27
Oxweld Acetylene Co. 28
Oxweld Railroad Service Co. 28

P

P. & M. Co. 1
Parsons Co. 24
Pease Co., C. F. 45
Positive Lock Washer Co. 42
Prest-O-Lite Co. 28

Q

Q. & C. Co. 6-7

R

Rail Joint Co. 37
Ramapo Ajax Corp. 29
Reliance Manufacturing Co. 2
Rife Engine Co. 44
Rodger Ballast Car Co. 31

S

Simmons-Boardman Pub. Co. 38-40-48
Sullivan Machinery Co. 43

U

Union Carbide Sales Co. 28

V

Verona Tool Works 54

W

Western Wheeled Scraper Co. 15
Wharton Jr. & Co., Inc., Wm. 44
Woolery Machine Co. 26

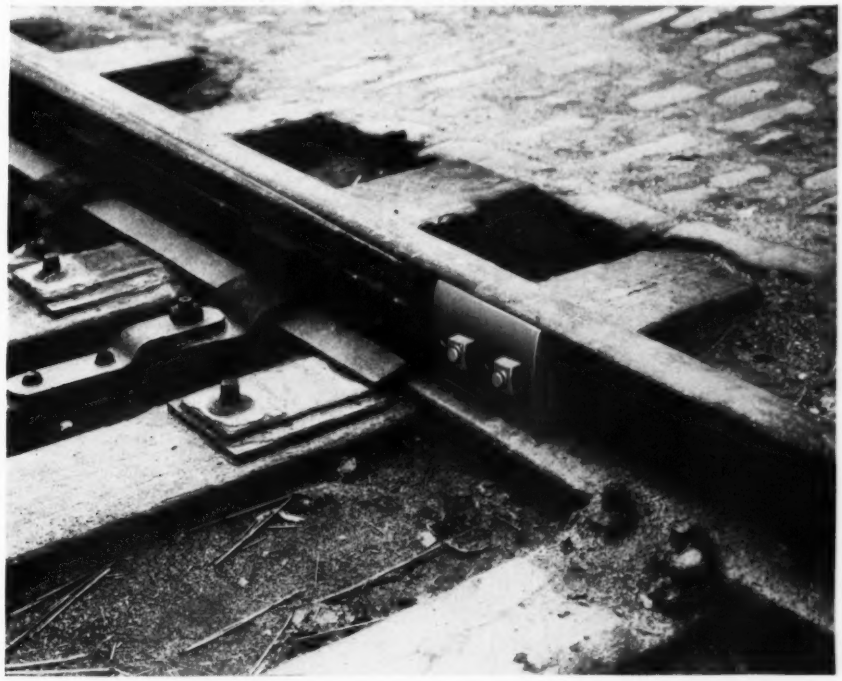
The Reversible "Mack" Switch Point Protector

THIS IS IT!

A NEW and distinct maintenance economy is made not only possible, but entirely practical, in the Reversible "Mack" Switch Point Protector. Mechanically, it is simplicity itself. As shown in the illustration, the "Mack" as now made, gives double the service by means of the simple operation of inverting it after one edge shows sufficient wear to make a new protector advisable.

In other words, the lower edge becomes the top edge and the service life of the protector extended to double the wear without additional cost.

Positively the most economical way to protect the switch point—and add years to its life.



An Economic and Safety Device

LET the Mack Switch Point Protector absorb the wear and increase the life of your switch points.

Mack Switch Point Protectors are simple, inexpensive, and positive in action. For switch points to last ten times longer with this protection is not uncommon in actual service tests.

Installation can be made easily at small cost—replacements are made in a few minutes by one man—their efficiency is not impaired by weather conditions.

"Mack" Switch Protectors are made of manganese steel, for any size rail.

Send us a description of rail used, and we will furnish you a few protectors for test

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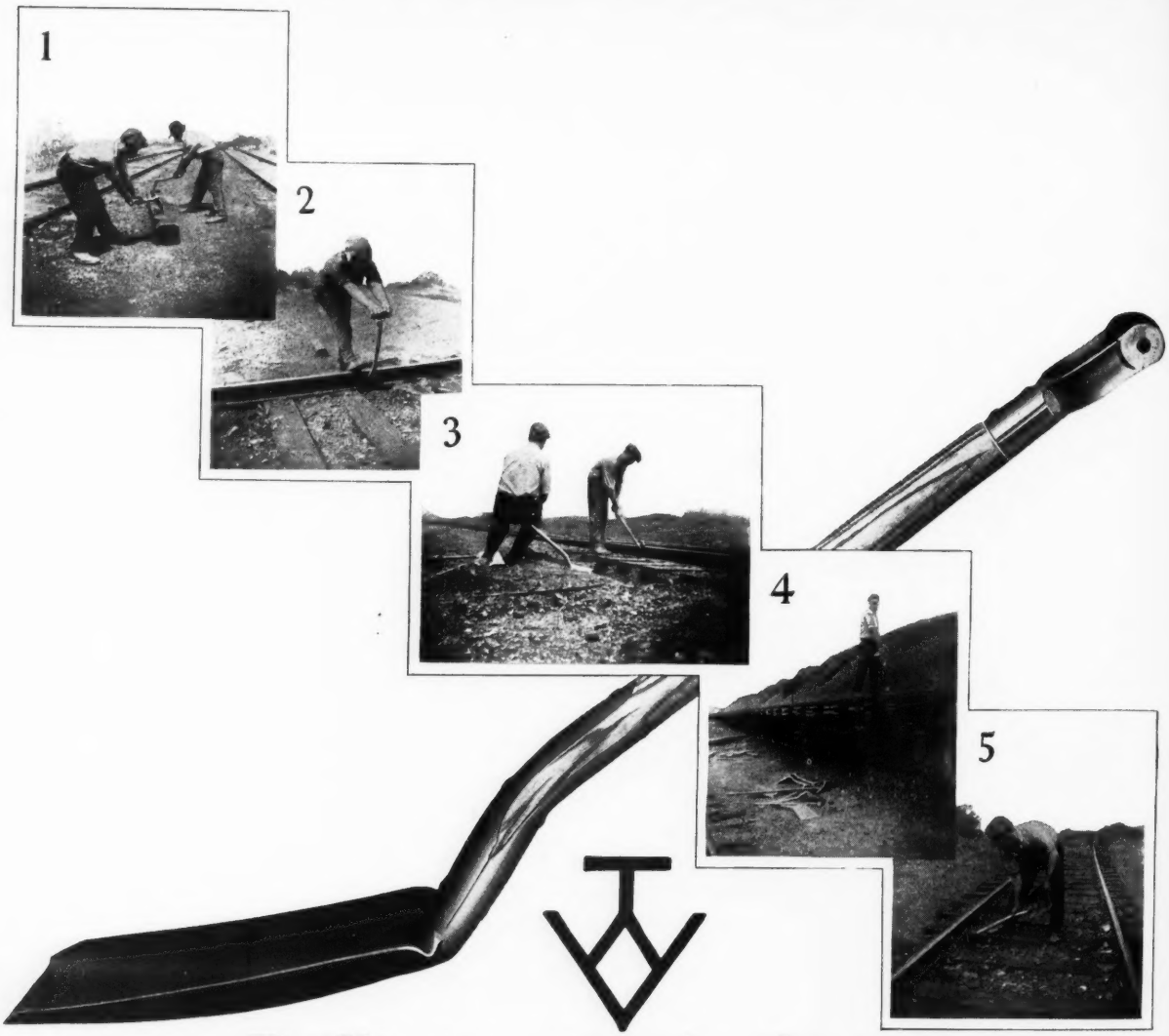

Built to stand abuse

As long as a shovel continues to be the most useful tool of a track man, it will be the most abused. We cannot stop the abuse, but we can build a shovel to withstand it.

The Verona Track Shovel is especially designed to resist the five common abuses shown above.

1. Dragging ties with a shovel is hard on the ties but cannot hurt a Verona. The hard, heat-treated, evenly hammered edge can stand almost any blow of actual service without denting, curling, or bending.

2. The practice of using the rail as a fulcrum to the shovel's lever breaks most shovels but only bends a Verona. The carbon steel back is annealed, and not only bends without breaking but can readily be restored to its original shape.

3. Using a shovel instead of a bar breaks the handle or the straps or the socket. Eighty-five per cent of all shovel failures occur between the point of the socket and the top of the straps. In the Verona shovel, this is the point of greatest strength. The close-fitting straps are attached to the blade by a deep rivetless weld. The handle, steam-bent with the grain, extends to the very bottom of the socket.

4. Dropping heavy tools on a pile of shovels is a frequent cause of broken handles. The Verona handles are of XX Grade northern white ash, seasoned for a year before use.

5. Because it is easier to tamp with the "top" or grip of a shovel than to pick up a tamping bar, many shovels fail at this point. The broad, splinterless top of the Verona shovel is designed for easy shoveling—not for strength as a tamping tool. Nevertheless, the birch grip, with its grain running in the right direction, and the heavy gauge steel of the top give it extraordinary strength. A hammer tap will stop a loose grip from turning. Two rivets provide a convenient take-up. In the event of failure, a whole new top can be applied at small cost.

These are just a few of the abuses the Verona shovel withstands. It is built and sponsored by track tool experts to meet the special demands of track work.

Order a dozen. Try them in competition with any other shovel.

VERONA TOOL WORKS Pittsburgh San Francisco New York New Orleans Chicago Washington Boston St. Paul St. Louis Denver